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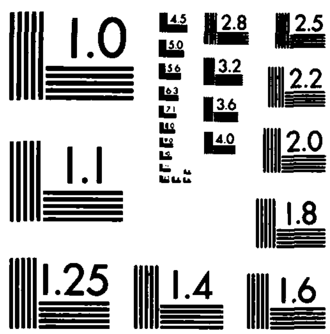
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18. SUPPLEMENTARY NOTES

A summary of technical issues and design choices in this task is contained in a companion report, "Navy Occupational Safety and Health--Resource Allocation Concepts," by the same author (March 1982). Summary is ADA113259

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Navy OSH; workplace safety and health; priority method; hazard assessment; hazard assessment code; matrix indexing; centralized budget management; hazard abatement projects; OCR reports.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A simple method of ranking projects requesting funds for hazard abatement in Navy workplaces ashore has been designed by SRI. The development of the method and its initial application are given in detail. Procedures are included to facilitate integrating the method into the Navy's centrally managed OSH deficiency abatement program.

Key features of the method are standardized basic data needs and a system of matrices which process the data into an integrated three digit code. Project-

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requests may thus be grouped by relative priority for funding consideration. Status of the Navy's plans to integrate this new management decision tool into its OSH planning, programming, and budgeting process is described.

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The research summarized in this report was conducted by SRI International (SRI) and supervised by Dr. Stephen L. Brown, Director, Center for Resource and Environmental Systems Studies (CRESS). The team performing the research was drawn from CRESS and two other SRI research centers, the Center for Occupational and Environmental Safety and Health (COESH), and the Center for Defense Analyses (CDA). The members of the project team were:

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SUMMARY

SRI International (SRI) has developed a systematic method for evaluating priorities of safety and health hazard abatement projects requested by Navy shore activity commands and submitted for approval and funding under the new centrally managed Navy Occupational Safety and Health (NAVOSH) program. The method prescribes basic data measurements and judgments needed and describes how they may be standardized and combined to score[a] each project. These scores reflect the relative severity of safety and health hazards to workers performing assigned work in a specific workplace; they give an indication of the cost effectiveness of the proposed corrective actions; and they provide a rating of the feasibility of discontinuing the operation or moving it elsewhere to eliminate or mitigate the hazard.

The steps taken by SRI to produce this priority method in a two-phase study sponsored by the Office of Naval Research were:

<u>Phase I</u>

- A full review of the on-going Navy Occupational Safety and Health program
- Creation of a working file of unfunded O&MN Occupational Safety and Health projects
- A literature survey of current techniques, in use or under development, for setting priorities during decision making
- Formulation of a conceptual priority method and selection of candidate techniques for implementing the method
- A field test of a prototype of the method on O&MN projects.

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[a]The composite score is a three digit number--the first digit represents the risk assessment, the second digit the cost and effectiveness of the corrective action, and the third digit is an indicator of the facility's need to implement the proposed corrective action.

Phase II

- An expansion of the method to adapt it for use with large MCON projects
- Refinement and adjustment of the method based on results of first-year operational use of the method.

Each of these steps is documented in this report.

The end product of this research--a NAVOSH priority method tailored to Navy needs and at least partially adjusted to realistic conditions--is now available to Navy management dealing with the increasingly demanding problem of allocating funds for occupational safety and health projects. On the basis of its first operational use the method appears to satisfy the Navy's criteria for a NAVOSH priority management tool. The method is relatively simple and easy to apply, it does not require large commitments of new resources to be effective, it is quite flexible in that it can be modified or augmented readily, and it makes possible a hitherto unavailable degree of systematic standardization of projects on the basis of risk categories.

In assessing the suitability of SRI's priority method as a component of the NAVOSH program for the future, the development tests revealed several problems of the kinds that may be encountered during the early years of employing the method. Using inputs from operational personnel, we have adjusted the method to alleviate or mitigate these potential problems. Nevertheless, the continuing success of the method will depend on its acceptance by those who will initiate and review future project requests. As a prime example, unless all the specific items of information and basic data required to complete the risk assessment portion of the NAVOSH data work sheet are provided by the originating activity, the scores cannot be compiled. To help solve this

problem, SRI suggests that instructions for the required Navy Occupational Safety and Health Inspection Program (NOSHIP) periodic surveys specify that these data be collected during each survey. This would facilitate integrating the priority method into the overall NAVOSH program.

Review authorities--Naval Facilities Engineering Command Engineering Facilities Divisions (EFD) and major claimants--must also endorse and support use of the method because it depends on their validation of the data provided by the originators. The method attempts to minimize descriptive paragraphs, substituting quantified multiple-choice data whenever possible. The reviewers must see to it that these data truly reflect the hazardous conditions and the corrective actions proposed if the method is to work properly. Even though the method does not require a large commitment of new resources, it does depend on a commitment to make it work on the part of all personnel who will be involved with it.

Several other suggestions for facilitating successful implementation of the priority method in the NAVOSH program are among the results of this research. Training of safety and industrial hygiene personnel in the new method is indicated as an initial step. Additional recommendations for improvements can be expected once personnel have been trained and are familiar with the operation of the new priority method in the NAVOSH system.

Finally, the structure of the method enables it to be adjusted as necessary to meet changing requirements. Future changes in NAVOSH may be needed to respond to possible changes in OSHA or DoD instructions. At present, OSHA is facing important legal questions regarding its rule making methods and procedures for setting standards. The issues behind these questions and how they may affect the Navy are discussed briefly in the concluding section of this report. This material is included

because technical, economic, and legal factors (i.e., feasibility of standards) are all considered in SRI's method of setting NAVOSH priorities. As these factors change, changes in the method may be quickly and easily made by replacing modules (matrices) as needed.

I INTRODUCTION

A. The Problem - Setting NAVOSH Priorities

This research addresses the problem of effectively apportioning the Navy's limited resources to correct[a] occupational safety and health (OSH) hazards in Navy onshore workplaces. Hundreds of projects are developed each year to correct such deficiencies. Many of these OSH projects are beyond the limit of local funding capability or authority and are therefore forwarded along the chain of command for special funding consideration at the level of the Chief of Naval Operations (OP 45).

Adequate management tools have not been available within the Navy to assist in determining priorities among these competing projects. Hence, the objective of SRI's research was to develop a method to facilitate setting Navy-wide priorities for OSH project requests within the framework of a total Navy Occupational Safety and Health (NAVOSH) management system.

B. Background

Broad policy and organizational responsibility guidelines for safety and occupational health are established under OPNAVINST 5100.8E (17 May 1970). Matters such as explosive safety, aviation safety, and nuclear weapons are covered in that instruction. The more narrowly defined Navy workplace occupational safety and health (NAVOSH) program is prescribed by OPNAVINST 5100.23. This 8 May 1979 instruction

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[a] The issues of technical, economic, and legal feasibility of correcting hazards are not part of this research, although they will be very important future concerns of NAVOSH management.

delineates the management structure within which the new prioritization method is to operate.

Correcting hazardous conditions promptly in workplaces throughout the United States is required by federal law[b]; doing so in the least costly yet effective manner is a responsibility of efficient management. In accordance with the OSH Act and Executive Order 11807, the Secretary of the Navy (SecNav) has directed that the Navy establish and maintain an aggressive, centrally managed occupational safety and health program (NAVOSH). The objective of this program is to provide all personnel at Navy installations (military and civilian employees alike) with workplaces meeting federal Occupational Safety and Health Administration (OSHA) standards as interpreted and prescribed by DoD. Under the NAVOSH program, workplaces will be inspected periodically to identify unsafe or unhealthful working conditions. Performing these inspections and developing an abatement plan for deficiencies that cannot be corrected within 30 days of discovery are responsibilities of the Commanding Officer of each installation.

The Navy shore installation OSH abatement plans are the basis for the NAVOSH projects. Because NAVOSH projects are extremely diverse, the Navy has found NAVOSH prioritization to be complex. Difficult decisions regarding allocation of funds among and within military programs are common enough. But NAVOSH project prioritization and funding decisions are particularly difficult because:

- Health hazards and safety hazards typically have few if any common bases for comparison.
- Many kinds and degrees of hazard consequences must be considered.

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[b] Occupational Safety and Health Act of 1970 (OSH Act), 29 USC, Section 651 et seq. (1976).

- o Uncorrected deficiencies may have either immediate or long-term impacts; potential effects on readiness vary accordingly.
- o OSH problems and how they are resolved can affect welfare and morale outside the workplace and may in some cases affect an entire community.

Factors such as these tax Navy decision-making processes in unusual ways. Various improvisations have been tried by major Navy commands to deal with this problem, but none is suited to centralized management.

The prioritization method that the Navy has asked SRI to develop must consider the chain of administrative organizations involved; take into account the complexities listed above; integrate the relevant DoD, SecNav, and OPNAV directives, such as the proper appropriation and funding thresholds; and function in the context of a centrally managed NAVOSH program. The priority method must then be integrated into the Navy Occupational Safety and Health Reporting (OCR) system, a computer data management and reporting system operated by the Navy Environmental Support Office (NESO).

Recognizing the complexity of the full problem, SRI undertook the research in two phases. The initial focus of SRI prioritization research was on NAVOSH projects that addressed single categorical hazards requiring relatively small commitments of construction funds (e.g., O&MN project requests). In a second phase, SRI broadened and adapted the method to make it suitable for prioritizing larger complex construction projects (i.e., OSH MCON) as well as smaller O&MN and OPN projects.

C. Organization of the Report

Section II describes SRI's research. Part A of Section II reports how in Phase I we built on prior work to design and field test a basic

NAVOSH prioritization method. Part B of Section II reports SRI's Phase II efforts to adapt the method for full operational use. Section III summarizes the current results of the priority method as a functioning component of the NAVOSH program. Section IV contains conclusions and recommendations for the future of the system.

Four Appendices are provided. Appendix A is a digest of prioritization methodologies reviewed in detail during this project; Appendix B is a complete description of the prototype prioritization method SRI recommended for trial implementation at the close of Phase I; Appendix C contains field test data sheets and evaluations used in the development of the prototype method presented in Appendix B. Appendix D provides examples of reports generated in the OCR system illustrating the implementation of the priority method in the NAVOSH management system.

II THE RESEARCH

A. Phase I - Design and Development of the Basic Priority Method

1. Review of NAVOSH Projects

SRI's plan for developing a prioritization method for NAVOSH deficiency abatement projects included an initial review of the then current (May 1979) files of requests for NAVOSH O&MN funding. The NAVOSH projects request files maintained at NAVFAC Headquarters were found to be loosely organized according to major claimants. To analyze the contents of these project requests, SRI reorganized these files by EFD. Each EFD file was divided by major claimant, then subdivided by activity with projects placed in sequence according to chronological project numbers assigned by each activity.

After restructuring the files, the SRI team transferred pertinent information from Special Projects[a] Step 1 and 2 submissions onto SRI-devised work sheets (see Table 1) to create an SRI working file.[b] We were then able to work with single work sheets instead of the original material in the files. In all, 293 individual work sheets were filled out on relevant NAVOSH projects.

Most of the project requests were initially filed in FY 1978 and 1979; however, some were originally submitted as early as 1975. All remained as candidates for funding according to the information available in the files.

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[a] OPNAVINST 11010-20D.

[b] Table 1 is an example of raw data files retained at SRI. The complete files are available for inspection on request.

Table 1
SRI WORKING FILE EXAMPLE

SRI INTERNATIONAL
INDEX # 66

EPD. LANT
UIC:

Major Claimant: Atlantic Fleet - CINCLANTFLT

Activity: Naval Submarine Base New London Groton, Conn. SUBASE - NEW LONDON

Project title: Install Sound Isolation Booths - Bldgs 29 + 40

Project number: C20-78

Step one submission	Step two	Other:	Status:
yes no	yes no		
Date: 10/3/78	Date: 11/22/78	Date:	

Project Description

Item: Install sound isolation booths - 4 for boiler operators - 1 for welding shop instructor.

Existing deficiency: Noise

OSHA violation: No.

Effective lifetime: 20 years

Factors involved: morale health safety fire protection security | Other:

Facility Description

Use:	Age:	Replacement Cost:
Bldg 29 - base heating and power facility 47,000 ft² - two story Bldg 40 - Support shops - 2 story - 40,000 ft²		

Health

Specific agent: Noise

Level of exposure:

Duration of exposure:

Population at risk:

Other:

Costs

Planning:	Construction:	Phasing: yes no Plan:	One year delay costs
~~$2.2~~ 1,800	~~$30~~ $29,500		7% annual

The SRI working file enabled the research to proceed without disrupting ongoing NAVFAC activities. The format of the restructured file provided additional flexibility in working with the data and included sufficiently detailed information to permit relating candidate prioritization systems to NAVOSH management's need for priorities among projects.

The review and the restructuring of the files also helped familiarize SRI project team members with the command (management) structure and the type and scope of NAVOSH hazards and corrective projects. We assumed that future projects would be similar to those already submitted. Our review led us to anticipate that the scope of projects could be very broad, covering such diverse topics as electrical systems, means of egress, exposure to chemicals, physical hazards, storage of hazardous materials, machine guarding and so forth.

2. Deficiencies in NAVOSH O&MN Project Documentation

The SRI work sheet was designed to record the minimum data required for a rough evaluation of the merit of a project. However, the data available from Step 1 and 2 submissions were inadequate to complete the worksheets, and some requests did not include both submissions. Generally, the submissions contained information on the date of submission, the nature of the project and its purpose, location, lifetime, and cost, but lacked specific information on the hazard, the population at risk, and the duration of exposure. Thus, data essential for a meaningful evaluation were usually missing. A data gap profile was prepared for each project.

Using the data gap profiles, an Information Request Sheet was developed (see Table 2)[a] to obtain the missing essential information.

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[a] Table 2 is an example of raw data files retained at SRI. The complete files are available for inspection on request.

Table 2
EXAMPLE OF AN INFORMATION REQUEST SHEET

CHESNAVFAC

Activity	Project Number / SRI INDEX #	Project Title	DATA GAPS (1) Specific Chemical Agent	(2) Level of Exposure	(3) Population at Risk	(4) Duration of Exposure	(5) Replacement Cost	(6) Effective Lifetime	(7) Specific OSHA Violation
NATNAV MEDCEN Bethesda MD	C2-79 / 25	Alterations for seamless flooring NNDC	X	X	X	X	X		X
DTNSRDC Annapolis MD	C(R)1-80 / 26	Remove and replace asbestos pipe insulation (OSHA)	X				X	X	X
DTNSRDC Bethesda MD	C1-80 / 27	Bldg. 1 Install explosion-proof lighting fixtures in paint shop	X	X	X	X	X	X	X
"	C2-80 / 28	General, ventilation improvement in various buildings						X	X
NAVSWC Dahlgren VA	C26-78 / 29	Install control measures to correct category I NAVOSH, Deficiencies for Class IIIB and IV Lasers-Bldgs. 343, 404, 452, 150	X	X	X	X	X	X	
"	C27-78 / 30	Provide proper exhaust systems to remove toxic fumes, VARLOCS, to correct category III NAVOSH deficiencies					X	X	
"	C28-78 / 31	Provide flammable storage lockers to correct category II NAVOSH deficiencies	X	X	X	X	X	X	
"	C29-78 / 32	Provide building ventilation to correct category II NAVOSH deficiences, VARLOCS	X				X	X	

Note: Blank squares represent the information requested.

To test the availability of various types of data these forms requested data on specific hazard (e.g., chemical agent), level of exposure, population at risk, duration of exposure, replacement cost, effective lifetime, and specific OSHA violations. The sheets were forwarded by NAVFAC to the six EFDs for completion.

The responses to the SRI Information Request sheets were received in early August. Included in the responses were notifications of cancellations of several project requests. The August 1979 accounting showed that 178 project requests from the original project request list were still candidates for FY 1981 funding; approximately 90 requests had been approved for FY 1980 funding.

The new data on the 178 unprogrammed projects were compiled and combined with the data obtained from the files. Inconsistencies in these new submissions illuminated the need for clarification of data needs, particularly data on exposures, to ensure that useful inputs would be received.

3. Review of Prioritization Methods

Setting priorities--invariably a complex management problem of prime importance--has received attention in recent decision theory research and we were aware that reports of a number of application studies were available. However, the extent to which the results of previous prioritization investigations might benefit this research was not known. By reviewing prior work by SRI and other researchers in this field, we hoped to find relevant information and thereby avoid unnecessary duplication and pitfalls encountered by others. Previous methods studied for possible application are identified below.

a. A Method SRI Developed for EPA

In 1978, SRI developed a method for the U.S. Environmental Protection Agency (EPA) to use in rapid ranking of environmental pollutants. The method is largely dependent on the systematized judgment of experts, supported and balanced by a more objective subsystem weighting model. With some modification, this method appeared useful as a model to (1) define the NAVOSH hazards in terms of selected cause and effects parameters; (2) group hazards with common causative parameters; and (3) show how relative values could be assigned to the effects parameters of each hazard.

b. Government/Industrial Methods

An on-going project at SRI, conducted under ONR auspices and identified as MOSHA,[a] developed a reference list of methods employed in government and industry for assessing the economic and operational impacts of OSH hazards and their corrective measures. A special review of 21 of these methods was made to identify techniques that might be appropriate for NAVOSH.

c. Navy Methods

Prioritization techniques in use or under development within the Navy were included in our review. Descriptions of these techniques are given in the sources listed.

- NAVFAC P-907, Second Edition, "Navy Military Construction Programming Procedures" (October 1976).

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[a] W. Schubert and L. C. Goheen, "Methodology for Navy Occupational Safety and Health Analysis; Phase I: Current Techniques," SRI International, Menlo Park, California (September 1979).

- "Priority Criteria Guidelines for NAVMAT Occupational Safety and Health Deficiency Correction Projects" (undated); describes a NAVAIR-developed Cost Effectiveness Value (CEV) method for prioritizing OSH projects.
- The "risk assessment" method developed by W. T. Fine at the Naval Ordinance Laboratory, White Oak, Maryland.
- J. S. Dyers' work at the University of Texas at Austin on application of Decision Analysis (sponsored by ONR).
- The continuing work on evaluating the Navy's asbestos hazards, conducted by E. Lory of the Navy Civil Engineering Laboratory, Pt. Hueneme, California.

d. Selected Prioritization Methods

After reviewing and screening SRI studies, Navy studies, and studies of other government and industry prioritization methods, we selected the 11 methods listed below as representative of the state of development of relevant prioritization methodology techniques:

a. *Cost-Benefit Fault Tree Analysis*
b. Cost-Benefit Type Methods
c. Department of Defense Risk Assessment Code Method
d. Expected Cost
e. Goal Programming
f. Hazard Priorities
g. Modeling
h. PATTERN
i. Project Rating Value System
j. Risk Assessment
k. Value Engineering

These methods were examined in detail. Summaries of these methods are presented in Appendix A. Table 3 lists the salient features of each method. The specific techniques employed in several of

Table 3

SALIENT FEATURES OF PRIORITIZATION METHODS

Potential Method	Data Needed	Source of Data	How Value Expressed	How Integrated	Disadvantages/ Sensitivities	Final Score
a. Cost-Benefit Fault Tree	Probability of occurrence of each set of accidents or illness (called events). Price[1] of each set of events not abated. Cost of abatement measure proposed.	Acuarial; surveys; judgment; tables of accident probabilities.	Reduction in expected price resulting from abatement is the effectiveness. Value is ratio of costs to benefit.	Fault trees constructed for each set of events. Tree has head event derived from separate events. Probability of occurrence of head event is calculated starting at lowest level of tree.	Loss of information; large effort to construct fault trees to get expected prices. Too sensitive as denominator of ratio approaches zero.	Dollars and ratios.
b. Cost-Benefit Types	Costs of abatement; benefits of abating each hazard.	Acturial, surveys, judgment	Dollars; utility function; number of illnesses or accidents prevented.	Benefit minus cost; ratio of benefit to cost; vector of costs and benefits.	Large commitment of resources to estimate values of benefits, loss of information.	Diverse, i.e., ratio, dollars and some units of benefit or utility.
c. DOD Risk Assessment	Each hazard expressed in terms of severity and mishap probability.	Judgment	Index number of severity combined with index number of mishap probability.	Matrix	Insensitivity to small increments in values; loss of information.	Scaled index from matrix.
d. Expected Cost	Expected numbers of each type of accident and illness; price expected to be incurred by each hazard; expected cost of each abatement measure.	Actuarial; surveys; judgment	Expected price of each hazard.	Weighted sum	Loss of information.	Dollars.
e. Goal Programing	Relationship of benefits to levels of abatement; relationship of intensity and frequency of exposure to injury or illness; costs of abatement measure; price of accidents and illness if hazard not corrected.	Actuarial; surveys; judgment	Priorities assigned to satisfying goals such as acceptable levels of accident or illness; degree of compliance with OSHA; acceptable accident/illness cost per worker.	Goal program.	Loss of information; controversy over goals and program.	Value of program achievement vector at optimal solution.

[1] "Price" is used herein to denote potential costs of unabated hazards; "costs" are costs to correct deficiencies leading to or creating hazards.

Table 3 (continued)

Potential Method	Data Needed	Source of Data	How Value Expressed	How Integrated	Disadvantages/ Sensitivities	Final Score
f. Hazard Priorities	Total number of workers (and others) exposed to hazard; relative severity of the hazard.	Judgment; actuarial	Number of people exposed (or frequency of injury.	Multiplication	Loss of information; costs not explicitly considered.	Scalar Index (no. of people multiplied by relative severity of hazard.
g. Modeling	Relationship of benefits to levels of hazard abatement; etc. (see Goal Programming above).	Actuarial; surveys; judgment	Equations of model.	Model	Large commitment of analytical resources to develop models.	Output values of model variables.
h. Pattern	Relevance network of occupational groupings; hazards; abatement project.	Judgment/Opinion	Relevance values assigned to nodes of the network.	Averaged opinions of experts.	Large commitment of resources; loss of information.	Scalar, i.e., average relevance rating.
i. Project Rating Value System	Mission of installation and role of facility; degree of deficiency (OSH); type of facility; investment aspects; major claimant's rating of mission and deficiency.	Surveys	Indices	Weighted Sum	Large effort; loss of detail.	Scalar Index
j. Risk Assessment	Results of accidents and illnesses; freq. of occurrence of event leading to accident or illness; cost of abatement; effectiveness of abatement.	Judgment; handbook	Index for each item of data (obtained from table in handbook).	Quotient of products.	Sensitive to values near zero; loss of information.	Scalar index or ratio.
k. Value Engineering	Benefits to be provided by each abatement measure; a ranking of all benefits; a ranking of all abatement measured with regard to each benefit.	Judgment	Rankings	Weighted Sum	Loss of information.	Scalar Index

the methods were explored further (see paragraph 5. below) for use in the NAVOSH prioritization method.

4. Requirements to be Met by a NAVOSH Prioritization Method

a. General

OPNAVINST 5100.23 (8 May 1979) states two essential requirements for an adequate NAVOSH prioritization method:

- It must include a method of assessing the relative cost effectiveness of projects.
- To avoid excessive demands on budgets or personnel, the method must be simple to apply.

To measure the adequacy of a candidate method, SRI developed criteria from these requirements for determining the extent to which a method might meet the OPNAV NAVOSH program needs. Obvious options for developing the NAVOSH priority method were: select an existing method; revise an existing method; combine features of several methods; and devise an entirely new method. In the interest of time and research efficiency, SRI's approach was to proceed through the development options until a prototype prioritization method was conceived to fulfill the key criteria. At this point, concept development would cease and a prototype method would be designed and field tested against the criteria.

b. Cost Effectiveness Criteria

To incorporate cost effectiveness evaluation in the NAVOSH prioritization method, the method had to be capable of characterizing the relative degree of health or safety risk caused by the hazard, the exposure (i.e., number of personnel in the workplace subjected to the risk), and the relative need at the facility (from an operational viewpoint) for abating the hazard (i.e., continuing the operation, but in a safe manner). It was important to note that compliance with standards (correcting deficiencies) was

not a matter of trading costs against degrees of deficiency abatement. Instead, unless the project brought the facility into full compliance with the standards by correcting the cited deficiencies, the project could not be accepted. Funding least cost alternatives that corrected identified deficiencies was the goal of NAVOSH, not marginal returns on investment or true cost-benefit principles. This meant that NAVOSH projects must be evaluated using cost effectiveness rules for "secondary analysis" as prescribed in NAVFAC P-442 "Economic Analysis Handbook." The importance of conducting a complete secondary analysis for large projects (MCON) is stressed in the section of this report that deals with Phase II of SRI's research.

c. Simplicity Criteria

To ensure its acceptance and successful use, the NAVOSH prioritization procedures had to employ relatively simple techniques and be quick to execute in order to minimize administrative burden. Furthermore, the data required had to be obtainable with a relatively small investment of time and resources (i.e., extensive testing to develop data would not be acceptable). These criteria reflected the need to utilize existing resources to the maximum extent in the preparation of project requests and in the general administration of the program. Although the NAVOSH program is of vital importance to an activity, resources committed to NAVOSH must be balanced against the facility resource requirements identified in the Basic Facility Requirements List (BFRL) for the activity.

5. Development of the Prototype

a. A General Concept

Review of the NAVOSH files gave the SRI project team an introduction to the expected kinds of projects to be prioritized, and the review of prioritization methodologies provided the team an understanding of the kinds of techniques that might be appropriate. Most important, as a result of these reviews we concluded that no existing system would be satisfactory as currently structured, and that none seemed readily modifiable

to meet the criteria. Given these conclusions, our next option was to explore whether features of several techniques could be combined to produce a workable method.

During continuing discussions of the prioritization methods and the projects we had reviewed, a general concept of a NAVOSH priority method emerged. The consensus among members of SRI's multidisciplinary team was that the hazard control assessment problem consisted logically of three major subproblems or components--assessment of the risk, assessment of the corrective action, and assessment of the necessity of performing the operation (now considered hazardous) in the facility as a part of its mission requirements.

It was argued that these separate assessments might be combined into a single overall value by one of the integration techniques surveyed. Alternatively, if each were expressed as a single value, perhaps it might be appropriate to list them in a three-digit symbol. It was agreed that listing offered two advantages over full integration--greater flexibility and less loss of information. Thus, if the assessments could be expressed simply, listing would be our choice. We also agreed that, if listing were used as the final expression of a project's priority, the rank order of the list should be "risk," then "corrective action," then "facility." The effect of this ranking rule would be to permit primary grouping by risk. Second order grouping would be by corrective action assessment, and third order grouping by the facility assessment.

The success of the listing method would depend on producing simple expressions for the three component assessments. Considering the complexity of OSH standards and the broad scope of the Navy OSH project requests, it was obvious that a relatively large number of data items (judgments and facts) would have to be combined before the risk and corrective action components could be expressed as simple values. Of the techniques we had selected as possible candidates for combining information, the matrix technique appeared to be the most appropriate. It allows integration and

direct trade-offs between interacting data over wide ranges; it is suited to relatively coarse-grained inputs, and it is readily adaptable to a process requiring repeated integration of complex parameters. Accordingly, we selected the matrix technique for combining information to produce the list values.

The several stages in the process of designing matrices tailored to the NAVOSH requirements and of specifying the data needed are discussed in the subsections that follow.

b. Structuring a Matrix Technique

We found that two of the major components of the hazard control assessment problem--risk and corrective action--could best be treated parametrically in developing the concept of the priority method. We chose "Mishap Profile (Safety)," "Hazard Severity (Health)," and "Personnel Exposure" as the risk-assessment parameters. For the corrective action factor we chose parameters of "Cost" and "Technical Evaluation." It was unnecessary to treat the facility requirements factor parametrically because the kinds of evaluations identified for this factor in the OPNAVINST (potential for relocation, expected life of hazardous operation) could be expressed in direct fashion.

The parameters were then reduced to the basic data items required to characterize each parameter. To facilitate standardization of terminology for the basic data, the units or form in which each item was to be expressed were defined. Figure 1 depicts the "assessment data tree" described here.

We had determined that much of the data displayed in the assessment tree of Figure 1 would be available only at the activity level and in the workplace of an installation. Others in the NAVOSH echelon would also have a role in the method. To permit proper review and evaluation, a series of interacting matrices was employed, some matrices requiring input evaluations as the project proceeded through the administrative chain.

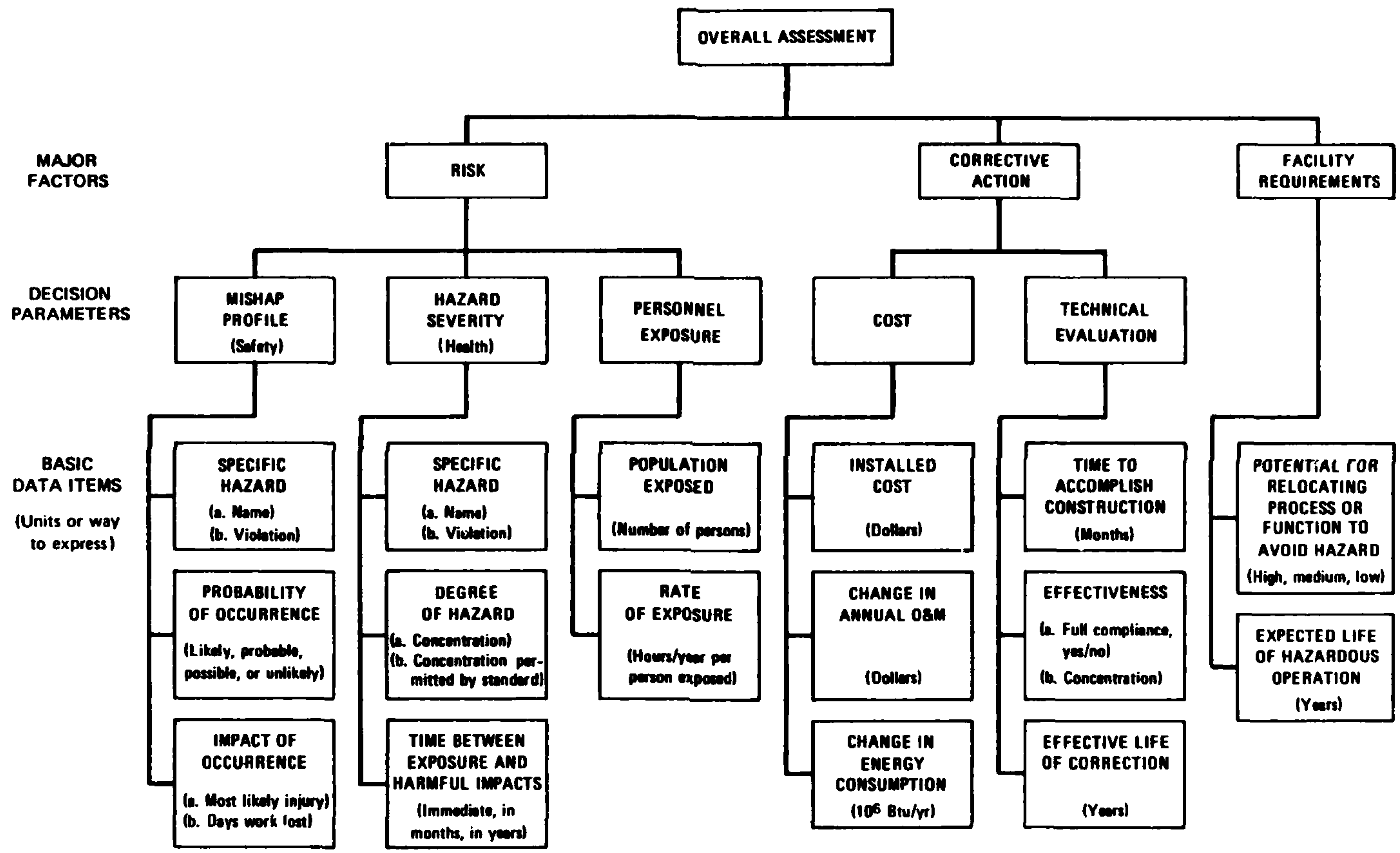


FIGURE 1. STRUCTURE OF HAZARD CONTROL ASSESSMENT

Our objective was to employ single-digit indices for evaluated and combined data items, then to aggregate the indices through the review echelons to produce a master index of the assessment factors at the top level. In theory this approach should make it possible to represent by groups of three digit priority numbers the overall upward review and evaluation of a large number of the hazard control projects. Figure 2 illustrates the principle of this concept.

The problem was to make the process that generated the indices (now seen as the elements of the assessment) simple and yet as rational as possible. A set of interacting two-dimensional matrices was designed to first combine basic data into subindices, and then to aggregate these subindices into overall indices. Figures 3a, b, and c show these matrices.

The vertical and horizontal cells of these matrices were developed empirically, initially by drawing on the judgment of our team members. Maximum use was made of existing OSHA guidelines and standards for representing degrees of hazards. In several stages, we experimented with and tested the matrix's two-dimensional cell descriptors and size groupings. Developing the matrices was a demanding part of this research. A spectrum of hazards was hypothesized. For every matrix lengthy discussions were required before a reasonable consensus of its structure could be reached. At all times we were guided by the requirements that the matrices fulfill the criteria of providing for least-cost effectiveness abatement and yet being as simple overall as possible.

The system of experimental matrices and empirical grids was completed by placing index values in the fields of the matrices. These values were subjected to preliminary trials using assumed basic data to fill data gaps for a sample of unfunded health and safety projects requests.

MAJOR FACTORS IN HAZARD CONTROL ASSESSMENT	DECISION PARAMETERS	BASIC DATA	HOW TO EXPRESS	INPUT	CALCULATED	OUTPUT
RISK		1	INDEX a. SAFETY b. HEALTH		I	O
(TYPE OR RISK, i.e. HEALTH OR SAFETY, IS IN OTHER OCR FIELD)	MISHAP PROFILE (Safety)	2	INDEX			
		3 SPECIFIC HAZARD	a NAME	X		
			b VIOLATION	X		
		4 PROBABILITY OF OCCURRENCE OF INJURY	LIKELY/PROBABLE/POSSIBLE/UNLIKELY	X		
		5 IMPACT OF OCCURRENCE	a MOST LIKELY INJURY	X	OR	
			b DAYS WORK LOST PER RECORDED INCIDENT	X		
	HAZARD SEVERITY (Health)	6	INDEX		I	
		7 SPECIFIC HAZARD	a NAME	X		
			b VIOLATION	X		
		8 DEGREE OF HAZARD	a CONCENTRATION, e.g. fibers/cc, ppm, mg/m^3)	X		
			b CONCENTRATION PERMITTED BY STANDARD	X		
		9 TIME BETWEEN EXPOSURE AND HARMFUL IMPACTS	IMMEDIATE/IN MONTHS/IN YEARS	X		
	PERSONNEL EXPOSURE	10	INDEX		I	
		11 POPULATION EXPOSED	NUMBER OF PERSONS	X		
		12 RATE OF EXPOSURE	HOURS/YEAR PER PERSON EXPOSED	X		
CORRECTIVE ACTION		13	INDEX			O
	COST OF CORRECTIVE ACTION	14	INDEX		I	
		15 INSTALLED COST OF CORRECTION (Including environmental control tech.)	DOLLARS	X		
		16 CHANGE IN ANNUAL O&M COST (Caused by correction)	DOLLARS	X		
		17 CHANGE IN ENERGY CONSUMPTION (Caused by correction)	10^6 Btu/Yr	X		
	TECHNICAL EVALUATION	18	INDEX		I	
		19 TIME TO ACCOMPLISH (Construction)	MONTHS	X		
		20 EFFECTIVENESS OF CORRECTIVE ACTION	a FULL COMPLIANCE Yes/No (Safety)	X		
			b CONCENTRATION, e.g. fibers/cc, ppm (Health)	X		
		21 EFFECTIVE LIFE OF CORRECTION	YEARS	X		
FACILITY REQUIREMENTS		22	INDEX		I	O
		23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO ANOTHER SITE TO AVOID HAZARD	HIGH/MEDIUM/LOW	X		
		24 EXPECTED LIFE OF HAZADOUS OPERATION	YEARS	X		
OVERALL EVALUATION		25	INDEX			A

X = Data provided by activity on project

} ⟶ Combination of bracketed items produces item indicated

I = Calculated indices

O = Output provided to users

A = Overall assessment as a three digit combination of the output indices

FIGURE 2. HAZARD CONTROL ASSESSMENT DATA FLOW

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* PROBABILITY OF OCCURRENCE OF INJURY: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	2	3
2500–4199	1	2	2	3
1200–2499	1	2	3	4
400–1199	1	2	3	4
100–399	1	3	3	4
30–99	2	3	4	5
< 30	2	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10–49	5–9	1–4
≥ 2000	1	1	2	2
960–1999	1	1	2	3
160–959	2	2	3	4
40–159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION	9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS			
ABOVE CEILING	1	1	1
> 2 x STANDARD	1	1	2
< 2 x STANDARD	1	2	3
NO STANDARD			
SEVERE RISK	1	1	1
MODERATE RISK	1	2	3
LOW RISK	2	3	5

Index 6

PERSONNEL EXPOSURE	SAFETY MISHAP PROFILE: 1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Safety Risk Index 1a → (See page 3)

PERSONNEL EXPOSURE	HEALTH HAZARD SEVERITY: 1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk Index 1b → (See page 3)

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A

FIGURE 3a. HAZARD CONTROL ASSESSMENT FOR RISK

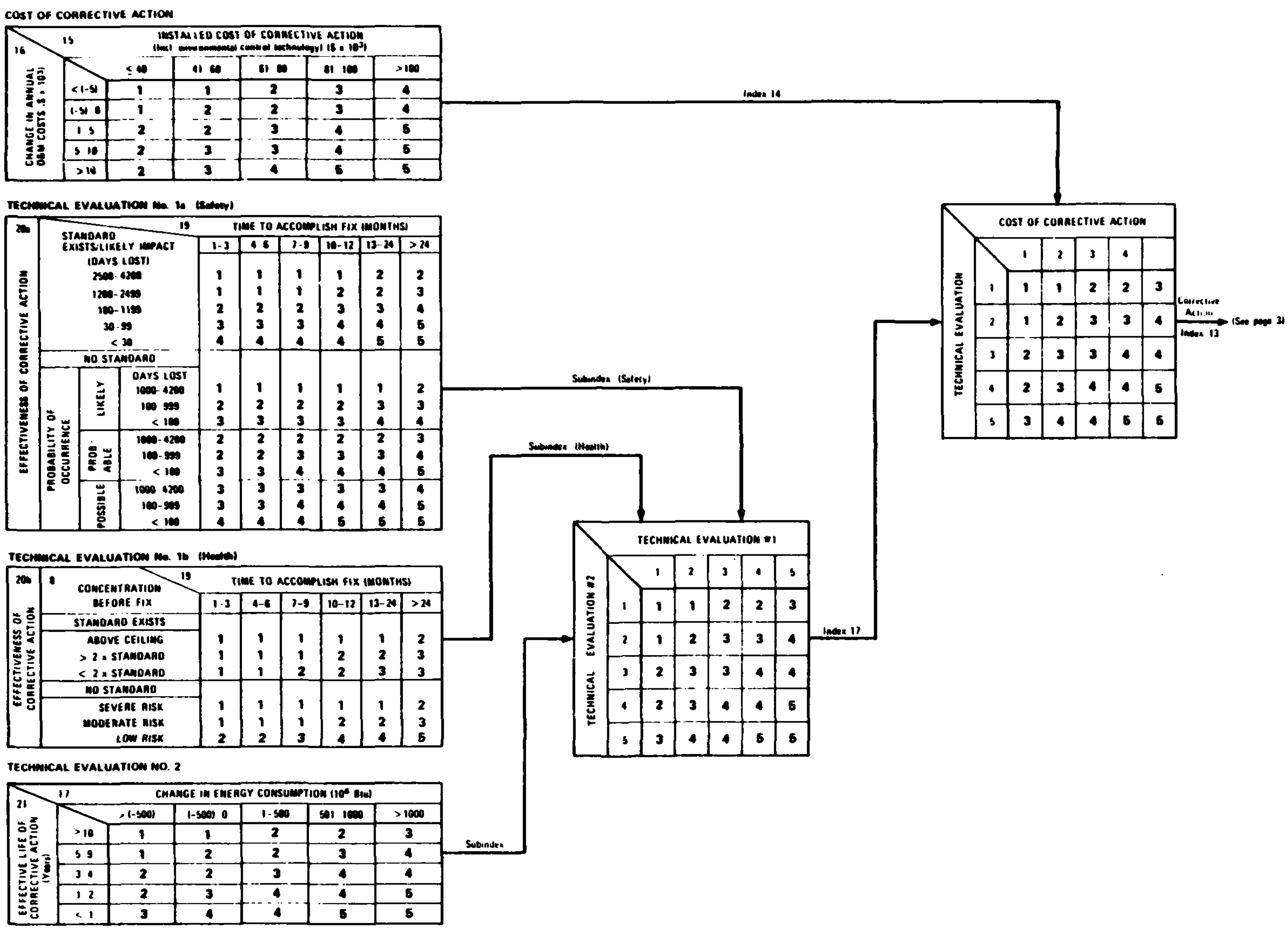


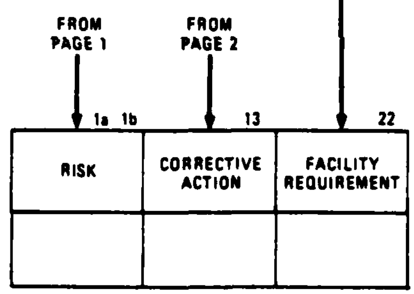
FIGURE 3b. HAZARD CONTROL ASSESSMENT (CORRECTIVE ACTION)

FACILITY REQUIREMENTS

24 EXPECTED LIFE OF HAZARDOUS OPERATION (Years) \ 23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION



SCORES

FIGURE 3c. HAZARD CONTROL ASSESSMENT

Although limited, the results of the preliminary trials showed that the experimental system of matrices could produce a spread of overall evaluation indices and that the relative values of these indices correlated well with what the values should logically be. The trials may have been unintentionally biased by our gap-filling data. Nevertheless, we concluded that with some adjustment, the prototype should be capable of producing meaningful results, and we therefore recommended it for field tests.

The data requirements of the prototype method were discussed with NESO personnel assigned to develop the NAVOSH automated data management system. Agreement was reached with NESO on a preliminary version of the format of prioritization data for use in the OCR system. This format is shown in Figure 4.

6. Field Test of the Prototype

The research team developed a field test of the prototype method designed to:

- Demonstrate the extent to which the method is capable of evaluating sample projects with respect to risk, cost, and effectiveness factors
- Provide direct evidence on which to judge whether the method is sufficiently simple and quick to execute
- Determine whether the data required by the method are obtainable through a relatively small investment of time and resources.

In addition to measuring how well the method met the design objectives, the field tests permitted the SRI project team to:

PROJECT NO: PROJECT NAME:

10. HAZARD CONTROL ASSESSMENT:

(SAFETY) = USE ONLY FOR SAFETY PROJECTS
(HEALTH) = USE ONLY FOR HEALTH PROJECTS

1. INDEX: _ _ _
2. INDEX: (SAFETY) _ _ _

3A. HAZARD NAME: (SAFETY)

3B. HAZARD VIOLATION: (SAFETY)

4. PROBABILITY: (SAFETY) _ _ _
5. IMPACT OF OCCURANCE: (SAFETY) (DAYS LOST/INCIDENT)

6. INDEX: (HEALTH) _ _

7A. HAZARD NAME: (HEALTH)

7B. HAZARD VIOLATION: (HEALTH)

8. DEGREE OF HAZARD: (HEALTH) (CONCENTRATION) (UNITS)

9. TIME BETWEEN EXPOSURE AND HARMFUL IMPACTS: (HEALTH) (IMMED., IN MONTHS, IN YEARS)

10. INDEX: _ _ _

11. POPULATION AT RISK: _ _ _ _ _ _
12. RATE OF EXPOSURE: (HR./YR./PERSON EXP.)

13. INDEX: _ _ _
14. INDEX: _ _ _

15. COST: (THOUSANDS OF $)
16. CHANGE IN ANNUAL O&M COST: (THOUSANDS OF $)

17. INDEX: _ _ _

18. TIME TO ACCOMPLISH: (MONTHS)
19A. CONCENTRATION: (AMOUNT) (UNITS)

19B. FULL COMPLIANCE: (YES OR NO)

20. POTENTIAL FOR RELOCATING ACTIVITY TO AVOID HAZARD: (HIGH, MED., LOW) _ _ _ _

21. CHANGE IN ENERGY CONSUMPTION: (MBTU/YEAR)
22. INDEX: _ _ _

23. EFFECTIVE LIFE OF SOLUTION: (YEARS)
24 EXPECTED LIFE OF HAZARD: (YEARS)

25. INDEX: _ _ _

PROJECT NO: PROJECT NAME:

11. COST OF SAFETY AND HEALTH MEASURES: (IN THOUSANDS OF DOLLARS)

	CONSTRUCTION				REPAIR				
FY	DESIGN	FND	CONSTR	FND	DESIGN	FND	CONSTR	FND	PROJECT NMBR

TOTAL CONSTR. COST: TOTAL REPAIR COST:

12. PROJECT SCHEDULE: AGENCY REG

DESIGN (COMPLETION): STATUS:

CONSTR (START): DESIGN START DATE:

CONSTR (COMPLETION): VARIOUS LOCATIONS:

OPERATION(START): DATE PUBLISHED:

FINAL COMPLIANCE:

13. MISCELLANEOUS DATA:

CLAIMANT:

REVISION NOTE:

PROPERTY RECORD CARD NO:

NAVY CATEGORY CODE:

BUILDING NO:

REMARKS:.

FIGURE 4. OCR FORMAT FOR PRIORITY METHOD

- Obtain opinions from Navy personnel at the installation level concerning the data requirements

- Become aware of the actual views and concerns of the originators of NAVOSH projects

- Receive first impressions of the utility of the prototype from chain-of-command NAVOSH project request reviewers.

Two teams of SRI professionals conducted the field tests simultaneously at selected Navy installations on the East and West Coasts of the United States. A list of NAVOSH projects was selected for evaluation by each team on the basis of the following:

- The two lists should contain projects that entail similar kinds of hazards.

- Both health and safety projects should be included on each list and in roughly equal numbers.

- Each list should contain approximately 15-20 candidate projects.

- At least two major claimants should be represented on each list.

- Projects representing small as well as large funding commitments should be included.

- Projects should be selected to minimize travel and lag times between visits to the installations.

During a 2-week field test period the method was applied to a sample of 37 actual unfunded NAVOSH project requests. From September 10 to September 21, 1979, two SRI teams visited 10 Navy activities in the United States. Tables 4 and 5 show the activities visited and the safety (S) and health (H) project requests reviewed during these visits.

Table 4

NAVY ACTIVITIES VISITED AND PROJECT REQUESTS
REVIEWED BY SRI EAST COAST TEAM

Index[a]	Activity	Project Title	Claimant	Type	$ x 10^3
14	NAT NAV MED CEN	Alter Exhaust Stacks	BUMED	S	187.8
22	NAT NAV MED CEN	Air Filtration Prostheses Lab	BUMED	H	25.9
23	NAT NAV MED CEN	Repair Exhaust Systems	BUMED	H	38.5
24	NAT NAV MED CEN	Air Filtration Dental Lab	BUMED	H	38.5
25	NAT NAV MED CEN	Install Seamless Flooring to Prevent Hg Traps	BUMED	H	28.6
40	NAVORDSTA Indian Head	Provide Noise Reduction Alterations	NAVSEA	H	89.5
41	NATC PATUX	Correct Electrical Deficiencies	NAVAIR	S	26.9
42	NATC PATUX	Correct Fire Safety Deficiencies	NAVAIR	S	14.1
43	NATC PATUX	Correct Ladder, Stair, Scaffold Deficiencies	NAVAIR	S	56.9
44	NATC PATUX	Correct Equip. Guard Deficiencies	NAVAIR	S	67.0
45	NATC PATUX	Correct Mechanical Deficiencies	NAVAIR	H	19.5
46	NATC PATUX	Correct Vent Deficiencies	NAVAIR	H	12.6
47	NATC PATUX	Correct Non-OSHA Deficiencies	NAVAIR	S	35.1
50	NRL WDC	Provide Safety Platform	ONR	S	82.7
52	NRL WDC	Asbestos Removal	ONR	H	188.5
	NARF JAX	Machine Guarding	NAVAIR	S	13.6
	NARF JAX	Replace Plating Shop	NAVAIR	H&S MILCON	

[a] SRI Working File reference number.

Table 5

NAVY ACTIVITIES VISITED AND PROJECT REQUESTS
REVIEWED BY SRI WEST COAST TEAM

Index[a]	Activity	Project Title	Claimant	Type	$ x 10^3
266	NAVREGDENCEN San Diego	Replace Floor Tiles	BUMED	H	47.7
267	NAVREGDENCEN San Diego	Replace Electrical Systems	BUMED	S	165
268	NAVREGDENCEN San Francisco	Replace Floor Tiles	BUMED	H	57.5
270	NAVOCEANSEACEN San Diego	Install Ventillation System	CHNAVMAT	H	59
271	NAVOCEANSEACEN San Diego	Construct Landing Guides	CHNAVMAT	S	51.2
272	NAVOCEANSEACEN San Diego	Install Ventillation System	CHNAVMAT	H	51.4
273	NSC - San Diego	Repair Sidewalks	COMNAVSUP	S	11
274	NSC - San Diego	Install Guard Rails	COMNAVSUP	S	14.4
276	NSC - San Diego	Install Safety Railing	COMNAVSUP	S	30.4
279	NSC - Oakland	Correct OSHA Deficiencies	COMNAVSUP	S	216
280	NSC - Oakland	Correct OSHA Deficiencies	COMNAVSUP	S	16
281	NSC - Oakland	Correct OSHA Deficiencies	COMNAVSUP	H	53.8
282	NSC - Oakland	Fire Suppression	COMNAVSUP	S	18
283	NSC - Oakland	Install Ventilation System	COMNAVSUP	S	18.1
284	PWC-San Diego	Carbon Monoxide Exhaust System	COMNAVFAC	H	49.5
286	PWC-San Diego	Carbon Monoxide Exhaust System	COMNAVFAC	H	66
287	PWC San Francisco	Construct Flammable Product Storehouse	COMNAVFAC	H	37.1
287	PWC San Francisco	Modify Battery Handling Facility	COMNAVFAC	H&S	88
290	NARF North Island	Correct OSHA Deficiencies	NAVAIR	H&S	305.1

[a] SRI Working File reference number.

Worksheets had been prepared on each project as background for the visits. Data available from SRI's working file and additional data received from the EFDs during the initial attempt to fill data gaps were entered on each project work sheet. An example work sheet is shown as Table 6.

At each activity, SRI team members contacted a representative of the Command amd the Public Works Office who had been notified of SRI's field test plans by NAVFAC. After a general discussion of our priority method, the team met with safety officers, industrial hygienists, and other personnel who had been actively involved in generating the project requests. Table 7 lists the personnel contacted. The work sheets prepared on the selected projects for that activity were reviewed with these personnel, who were asked to assist us in filling the data gaps.

Each data item on the work sheet was defined, discussed, and explained as necessary. Data gaps were filled when possible. In most instances, the SRI team visited the workplace related to the project requests for orientation and further clarification of the hazardous situation there. However, SRI did not attempt to change the data already submitted by the activity on the project request or to discuss or evaluate the merit of the project.

The field visits produced constructive comments and generally favorable reactions to the priority method. Specific comments were obtained concerning the work sheets and the data items. Thirteen of the 32 work sheets were completed. The comments and suggestions received are summarized on Tables 8 and 9. On the basis of these comments, the original worksheet was redesigned as shown in Table 10. The new form eliminates ambiguous terms and adopts a "multiple choice" approach to providing many of the needed data. This new work sheet is a significant step toward achieving simplicity essential to the system.

Table 6

SRI NAVOSH DATA WORKSHEET
(Original Form)

PROJECT
Activity: ______________________ By: ____________
SRI Index No.: ______________________ Date: ____________
Project Title: ______________________________________
EFD: ____________ UIC: ____________ Claimant ____________

RISK
circle one:
*1.a SAFETY 1.b HEALTH

3.a Specific Hazard ____________ 7.a Specific Hazard ____________

3.b Hazard Violation: ____________ 7.b Hazard Violation ____________

4. Probability ____________ 8. Degree of Hazard
(likely,probable,possible,unlikely) (Concentration): ____________
Units: ____________
5.a Type of Injury: ____________
9. Time Between Exposure and Harmful Impacts:
____
(Immediate, in months, in years)

POPULATION
11. Population exposed to hazard: ____________
12. Rate of exposure to hazard: ____________
(hour/year per person exposed)

FIX
15. Installed cost of fix (including environmental control technology--if applicable) $ ____________
16. Change in annual O&M cost: $ ____________
18. Time to accomplish: ____________
(months)

EFFECTIVENESS OF FIX
19.a SAFETY 19.b. HEALTH
Full Compliance ____________ Concentration: ____________
(Yes or No) (Units): ____________
20. Effective Life of Solution ____________
(Years)
21. Change in Energy Comsumption Caused by Fix: ____________
(10^6 Btu/year)

FACILITY
23. Potential for Relocating Activity to Avoid Hazard: ____________
(High, Medium, Low)
24. Expected Life of Hazardous Operation: ____________
(Years)

Table 7

LIST OF PERSONNEL CONTACTED BY SRI TEAMS
DURING FIELD VISITS, 10-21 SEPTEMBER 1979

Activity	Personnel	Title
NAVMEDCEN-Bethesda	Lt. Richard Howell	Assistant Public Works Officer
"	John Lewis	Chief, Engineering Design BR, Public Works Office
"	Lt. David Todd	Engineering Support Department
"	Lt. (jg) David Croxton	Operations Management Department
"	Lt. (jg) Anthony Pugrano	OSH Office
"	Lester Slayback, Jr.	Head, RadSafe Department
NAVORD Station, Indian Head	Richard Wickman	Public Works Office
"	David Peacock	Safety Officer
NATC-PATUKENT	Ronald Wimmer	Public Works Office
"	Harry Dalton	Safety Officer
NRL-WDC	Robert Flournoy	Chief Engineering, Plans P.W.O.
NARF-JAX	Lt. Hunt	Public Works Department
"	John Kinstle	Planning-NARF
"	John Owen	Project Officer-NARF
"	Thomas Germann	I.H. Reg. Med Center
"	Roland Byrd	Supervisor, Reg. Med Center
"	William Giggins	Safety Officer-NARF

Table 7 (Concluded)

LIST OF PERSONNEL CONTACTED BY SRI TEAMS
DURING FIELD VISITS, 10-21 SEPTEMBER 1979

Activity	Personnel	Title
NRDC-San Diego	Larry Norton	Safety Manager
NOSC-San Diego	Charles Bourden	Safety Specialist
"	Donald DeFrain	Facilities Engineer
"	Ken Earle	Facilities Engineer
NSC-San Diego	Martin Martinez	Safety Specialist
NSC-Oakland	Ronald Davis	Facilities Engineering
"	Victor Gibson	Facilities Engineering
"	Samuel Phillips	Safety Specialist
PWC-San Diego	Monroe Billingsley	Safety Manager
"	Robert Jackson	Safety Specialist
"	Len Cartwright	Transportation Manager
NARF-North Island	Matt Rosa	Safety Manager
"	Del Holstrom	Facilities Engineer
"	Ron Okiniku	Industrial Hygienist
"	John Parker	Facility Manager
WESTDIV-San Bruno	Warren "Bud" Bossert	Engineer
"	C. Thorne Johnston	Head, Environmental Engineering Section
WESTDIV-San Diego	Joe Kaminski	Environmental Engineer
"	David Fisher	Environmental Engineer
"	Norm Schmokel	Environmental Engineer

Table 6

GENERAL COMMENTS RECEIVED DURING FIELD VISITS
ON THE SRI PROTOTYPE NAVOSH PRIORITY METHOD

- Method appears complicated at first; may work if data can be obtained.
- A much needed improvement--seems to get at the real problem.
- Will work if industrial hygiene and engineering personnel want to work together to make it work.
- Don't believe it can handle a project consisting of many different (usually) small hazards; OSH surveys can lump hazards into general categories (e.g., surveys performed by Occusafe Co.).
- A system is needed. The method appears useful if the rest of the system is developed (e.g., training, survey instruction, guidance on meeting funding criteria).
- Satisfied with present method, Cost Effectiveness Value (CEV) as being implemented within NARFs; SRI method was not needed.
- Public works and safety office are badly understaffed; the last thing we want to see is some new requirement or form to fill out.
- A&E's prepare our projects; who is going to teach them the method?
- A new approach is needed; present system does not contain the data NAVFAC needs to make a proper decision.
- How do you classify a project when the hazard affects both health and safety?

Table 9

SUMMARY OF COMMENTS RECEIVED DURING FIELD VISITS
ON THE WORKSHEET AND DATA ITEMS

- The form should include the name of Sub Major Claimant.
- The activity should be given the opportunity to assign their our priorities to each project.
- "Type of Injury" should be of the "most likely" injury.
- "Degree of Hazard" is a confusing term. Many suggested calling this "concentration."
- The form should include the current standard(s) and their units.
- "Population Exposed" should only estimate the normal working occupants of the hazard area.
- The term "fix" was misleading; correction or corrective action was suggested.
- "Time to Accomplish" was too vague since it could include the time to get the project funded, designed, constructed, and inspected.
- "Potential for relocating activity" was very confusing; most suggested to change the word "activity" to "function" or "process."
- It was suggested that the section attributed to health, numbers 1B through 9, contain such information as the method of analysis of occupational samples, the sampling times involved in collecting samples, and the type of sample collected, whether personal or area sample.
- The form would be much easier to complete if each of the questions could be answered by multiple choice because the choices would show the range of responses needed.

Table 10
NAVOSH DATA WORKSHEET
(Revised)

ACTIVITY______________________ INITIATED BY:______________________
ACTIVITY PROJECT NO.____________ DATE:______________________
PROJECT TITLE:____
EFD:________ UIC:________ CLAIMANT:________ SUB CLAIMANT:________

RISK

Check one SAFETY HEALTH

SAFETY	HEALTH
Specific Hazard______________	Specific Hazard______________
Hazard Violation (Regulations)_____	Hazard Violation (Regulations)_________
Probability (Check one) Likely Probable Possible Unlikely	Concentration of Hazard:__________ Units:__________
Severity of most likely injury_____	Current Standards:__________ Units:__________
	Time Between Exposure and Harmful Impacts (Check One) Immediate In Months In Years

POPULATION

Normal Working Population Exposed to Hazard (Employees) (Check One)

1-4 Employees	5-9 Employees	10-50 Employees	>50 Employees

Rate Of Exposure To Hazard (Hours/Year per Person Exposed) (Check One)

40	40-150	151-959	960-2000	>2000

Table 10 (Concluded)

CORRECTIVE ACTION

Installed Cost of Corrective Action ($\$x10^3$) (Check One)

40	40-60	61-80	81-100	>100

Change in Annual O&M Cost ($\$x10^3$) (Check One)

<(-5)	(-5)-0	1-5	6-10	>10

Change In Energy Consumption Cuased by Corrective Action (10^6 BTu/Year) (Check One)

<(-500)	(-500)-0	1-500	501-1000	>1000

Time To Accomplish the Construction of Corrective Action (Months) (Check One)

1-3	4-6	7-9	10-12	>12

EFFECTIVENESS OF CORRECTIVE ACTION

Safety--Full Compliance (Check One)   Health--Concentration:________________
Yes   No   Units:________________

Effective Life Of Solution (Years)________________________________

FACILITY

Potential for Relocating the Process or Function to Avoid the Hazard (Check One)

HIGH	MEDIUM	LOW

Expected Life of Hazardous Operation (Years)________________________

The work sheets completed during the field test were analyzed to assess the state of development of the priority method. We were interested to discover whether the prototype method produced overall hazard control assessment ratings for the sampled projects that satisfied our design criteria of:

- Spreading the ratings assigned in a reasonable fashion among the projects

- Assigning ratings to each project that appeared on a relative basis to be rational.

The data from each completed worksheet were entered into the prototype matrix system, to obtain an overall evaluation (or hazard control assessment) for each project. The work sheets and their completed matrices are given in Appendix C. The results of these rating efforts are summarized in Table 11.

In examining these ratings, we observed that:

- The scores of 13 projects of the sample that could be rated were appropriately spread among 10 rating values.

- The scores in most cases appeared reasonable; i.e., they ranked projects in an acceptable relative order.

It appeared that the prototype satisfied the design criteria, although only 13 of the 32 projects selected could be used to test the "factor ranges" and the distribution of index values assigned in the cells of the matrices.

Table 11

RESULTS OF RATING EFFORTS FOR SAMPLE PROJECTS

Index[a]	Activity	Project Title	Claimant	Priority[b] Score	Rank[b]
14	NAT NAV MED CEN	Alter Exhaust Stacks	BUMED	Note 1	-
22	NAT NAV MED CEN	Air Filtration Prostheses Lab	BUMED	232	5
23	NAT NAV MED CEN	Repair Exhaust Systems	BUMED	Note 1	-
24	NAT NAV MED CEN	Air Filtration Dental Lab	BUMED	232	5
25	NAT NAV MED CEN	Install Seamless Flooring to Prevent Hg Traps	BUMED	121	1
40	NAVORDSTA Indian Head	Provide Noise Reduction Alterations	NAVSEA	221	4
	NAVORDSTA Indian Head	Lead Fumes	NAVOSH	332	8
41	NATC PATUX	Correct Electrical Deficiencies	NAVAIR	Note 2	-
42	NATC PATUX	Correct Fire Safety Deficiencies	NAVAIR	Note 2	-
43	NATC PATUX	Correct Ladder, Stair, Scaffold Deficiencies	NAVAIR	Note 2	-
44	NATC PATUX	Correct Equip. Guard Deficiencies	NAVAIR	Note 2	-

[a] SRI Working File reference number.

[b] The three-digit score is based on preliminary data; it should not be used for any purpose other than this research.
Note 1: Insufficient data.
Note 2: Lumped hazards.
Note 3: Data appeared inconsistent.
Note 4: Project completed.

[c] Rank given is for use in this research only.

Table 11 (Continued)

RESULTS OF RATING EFFORTS FOR SAMPLE PROJECTS

Index[a]	Activity	Project Title	Claimant	Priority[b] Score	Rank[b]
45	NATC PATUX	Correct Mechanical Deficiencies	NAVAIR	Note 2	-
46	NATC PATUX	Correct Vent Deficiencies	NAVAIR	Note 2	-
47	NATC PATUX	Correct Non-OSHA Deficiencies	NAVAIR	Note 2	-
50	NRL WDC	Provide Safety Platform	ONR	321	7
266	NAVREGDENCEN San Diego	Replace Floor Tiles	BUMED	321	7
267	NAVREGDENCEN San Diego	Replace Electrical Systems	BUME	Note 2	-
268	NAVREGDENCEN San Francisco	Replace Floor Tiles	BUMED	Note 1	-
270	NAVOCEANSEACEN San Diego	Install Venti-lation System	CHNAVMAT	342	9
271	NAVOCEANSEACEN San Diego	Construct Landing Guides	CHNAVMAT	Note 4	-
272	NAVOCEANSEACEN San Diego	Install Ventila-tion System	CHNAVMAT	Note 1	-
273	NSC San Diego	Repair Rod Storage Racks	COMNAVSUP	314	6

[a] SRI Working File reference number.

[b] The three-digit score is based on preliminary data; it should not be used for any purpose other than this research.
Note 1: Insufficient data.
Note 2: Lumped hazards.
Note 3: Data appeared inconsistent.
Note 4: Project completed.

[c] Rank given is for use in this research only.

Table 11 (Concluded)
RESULTS OF RATING EFFORTS FOR SAMPLE PROJECTS

Index[a]	Activity	Project Title	Claimant	Priority[b] Score	Rank[b]
274	NSC San Diego	Install Guard Rails	COMANVSUP	Note 1	-
276	NSC San Diego	Install Safety Railing	COMANVSUP	Note 1	-
279	NSC Oakland	Correct OSHA Deficiencies	COMNAVSUP	221	4
280	NSC Oakland	Correct OSHA Deficiencies	COMNAVSUP	Note 2	-
281	NSC Oakland	Correct OSHA Deficiencies	COMNAVSUP	Note 2	-
282	NSC Oakland	Fire suppression	COMNAVSUP	Note 1	-
283	NSC Oakland	Install Ventilation System	COMNAVSUP	434	10
284	PWC San Diego	Carbon Monoxide Exhaust System	COMNAVFAC	141	2
286	PWC San Diego	Carbon Monoxide Exhaust System	COMNAVFAC	Note 3	-
287	PWC San Francisco	Construct Flammable Product Storehouse	COMNAVFAC	Note 1	-
287	PWC San Francisco	Modify Battery Handling Facility	COMNAVFAC	Note 1	-
290	NARF North Island	Correct OSHA Deficiencies	NAVAIR	Note 1	-

[a] SRI Working File reference number.

[b] The three-digit score is based on preliminary data; it should not be used for any purpose other than this research.
Note 1: Insufficient data.
Note 2: Lumped hazards.
Note 3: Data appeared inconsistent.
Note 4: Project completed.

[c] Rank given is for use in this research only.

Although the sample was small and the evaluation preliminary, we concluded that the prototype could become fully effective by iteratively adjusting the matrices. We recommended that NAVFAC proceed with iterative development of the priority method, implementing the prototype for a 1-year operational trial. Questions brought out by our analyses to be addressed during further development included:

(1) Should the values of the subdivisions for data item 11, Number of People Exposed, be changed? Indications were that the "more than 50," "10-49," "5-9," and 1-4" subdivisions may be too large, especially the "10-49" subdivision.

(2) Should the values of the subdivisions for data item 12, "Rate of Exposure," be changed? Concern has been expressed that the subdivisions "160-959" and "960-1,999" should be further divided.

(3) How can "mixed hazards" be handled?

B. Phase II* Expansion and Adjustment of the Method

A review was conducted with NAVFAC in December 1979 of the results of SRI's Phase I research. NAVFAC highlighted the need for further work to broaden the scope of the prototype method. SRI's recommendation for an operational trial of the method was accepted. Phase II was initiated in March 1980 to develop procedures designed to give the prototype full operational capability.

1. Guidelines for MCON Projects

In its prototype form, the method was designed to deal with the total investment cost only and with a single hazard, e.g., O&MN and OPN projects packaged in this simple form. Thus the prototype method had no provisions for taking into account life cycle costs of alternative abatement actions, nor did it have procedures to deal with combination projects; i.e., single projects designed to correct multiple hazards. We concluded that these important limitations of the prototype had to be removed if the method were to be useful for setting NAVOSH priorities in general, and for MCON projects in particular. Work to extend the scope of the method and address these limitations is described below.

2. Life Cycle Costing

A basic requirement in documenting an MCON project is the preparation of a detailed cost estimate to complete DD Form 1391. Each technically feasible alternative that corrects the hazard(s) must be subjected to economic analysis employing life cycle costing methods prescribed in NAVFAC P-442, "Economic Analysis Handbook." Life cycle costing requires careful consideration of recurring costs attributed to

* Phase II was conducted under a separate ONR contract as a continuation of SRI's priority method research initiated under Phase I.

the alternative over the operating life of the facility in addition to the one-time investment costs of the alternative. The alternative with the least Net Present Value (NPV), or the least Uniform Annual Cost (UAC), is the preferred alternative to be recommended in the project request.

Recurring costs introduce costs and benefits over time (often 20 years or more) together with concepts of economic life, technical life, or operational life as the time base for assessing the hazard and the corrective action. These feature were not taken into account in the prototype priority method.

NAVOSH MCON project requests on file at NAVFAC were reviewed to determine how and at what stage in the current development process of a project the life cycle costs of alternatives are documented. It appeared that a minimum 2- or 3-year cycle of submission, review, resubmission, and final review was required to produce a fully documented, acceptable project. Of 72 unfunded projects in the file, only 8 contained fully documented life cycle costing of alternatives.

The NAVFAC files contained evidence that costing was a problem area at present and was likely to remain so in dealing with NAVOSH MCON project requests. But there was scant evidence concerning current methods of evaluating alternative abatement actions and their costing. To understand these problems and how they might be dealt with in the NAVOSH system, we obviously needed to examine project request preparation at the activity and major claimant levels before attempting to develop procedures to introduce elements of life cycle costing into the priority method.

A meeting was held with NAVFAC System Analysis Division personnel to explore possible ways of factoring investment costs into the priority method to satisfy the objectives of the NAVOSH program. At the outset of these discussions, it was emphasized that one of the main

objectives of the NAVOSH program was to use the "fenced" NAVOSH funds cost effectively to abate the most serious hazards as soon as possible within yearly budgetary constraints. This underlined the importance of costing criteria in the priority method. The guidelines of the NAVOSH program set forth meeting of standards as the effectiveness measure. This implied that a project that did not abate the cited hazard sufficiently to satisfy the standard was unacceptable; one that more than met the standards should receive no added credit and might, in fact, be penalized for being overly costly unless it could be shown that the added protection was no more costly than the least cost acceptable abatement option.*

Additional discussions with NAVFAC program management personnel brought out that NAVOSH MCON investment costs could be considered to consist of three types: (1) construction or equipment related costs to abate a defined hazard; (2) capital costs that would facilitate or indirectly support the abatement costs; and (3) one-time investments that would reduce the recurring costs by increasing personnel efficiency or productivity, or by reducing the operating and maintenance costs over time. We noted that these latter investments might also benefit the NAVOSH program by improving the environment or the esthetics of the workplace. But they would not contribute to the immediate abatement of the cited hazards. Despite their possible value as side effects, these investments could not be considered to be highly relevant costs.

From these discussions, SRI devised a simple expression as a possible way to measure the relevance of the total cost of a project to the NAVOSH program objectives. This expression we called the "OSH relevancy value" (ORV). The ORV was defined as equal to the ratio of

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* The complexity of costing in relation to future benefits is discussed further in Section IV.

the sum of direct abatement costs (direct costs, D) plus a fraction of supporting costs (S), plus a fraction of all other costs (other costs, O) to the total project costs (T), or

$$ORV = \frac{D + \frac{S}{a} + \frac{O}{b}}{T} \qquad \text{Eq. (1)}$$

Arbitrary values of 2 and 4 were assigned to a and b respectively in equation (1), and trial computations were made of the ORV's for six of the eight MCON projects in NAVFAC files for which the cost data were complete. Example calculations of ORV are shown in Table 12.

Our trial computations of ORV for complex projects (i.e., projects addressing multiple facilities and hazards) made it obvious that clear definitions and additional procedures would be needed if this ORV technique were to produce reasonably standardized values. Because many of the NAVOSH MCON projects proposed were of the complex type as a matter of Navy policy, this was an important area in which to expand the applicability of the priority method.

3. Combination Projects

The policy behind complex, combination projects is based on the widely accepted engineering and contract administration principle that design and contracting cost savings result when it is operationally feasible to aggregate items of work into a single package rather than to contract each item separately. However, relating this policy to NAVOSH piorities raises the questions of whether a limit to the dollar size of a project should be set or whether a special cost benefit function should perhaps be used in prioritizing combination projects. Without some constraint, it is possible for a few large combination projects--each correcting a single critical hazard but also covering numerous minor hazards--to swamp the cost-benefit competitive budgeting process. This would abort the NAVOSH program objective of giving

Table 12

EXAMPLE OF OSH RELEVANCE VALUE (ORV) CALCULATIONS

A. Project Description - Correct OSH, fire protection, structural, and mechanical deficiencies and provide additional space (5210SF) to ease congestion in materials warehouse.

B. Corrective Action - Alternate A - New Building;
Alternate B - Rehabilitate existing facility.

C. Investment Costs

Alternate A		Alternate B	
1. Building	$851,000	1. OSH Corr.	$310,000
2. Added space	400,000	2. Fire Corr.	465,210
3. Electrical	43,000	3. Structural/Mech	458,503
4. Mechanical	26,000	4. Added Space	597,118
5. Installed Equip.	508,000	Total	1,830,831
6. Roads	32,000		
7. Site Improv.	31,000		
8. Demolition	29,000		
Total	1,920,000		

D. Uniform Annual Costs

Alternate A	$260,892	Alternate B	$262,652

E. ORV Calculations

D = Item 1 above =	351,000	D = 1 + 2 =	775,210
S = Items 3,4,5 =	577,000	S = 3 =	458,503
O = Items 2,6,7,8 =	492,000	O = 4 =	597,118
T = =	1,920,000	T = =	1,830,831

$$ORV = \frac{851 + \frac{577}{2} + \frac{492}{4}}{1920} = 0.6$$

$$ORV = \frac{775 + \frac{458}{2} + \frac{594}{4}}{1830} = 0.6$$

funding priority to projects which abate the most serious hazards in the shortest possible time.

Several possible ways to deal with combination projects in the priority method were investigated. It was theorized that a composite cost effectiveness function, perhaps a form of savings-investment ratio, might be created to optimize the tradeoff between costs saved by aggregating work items and reductions in net present value of overall program benefits likely to result when low priorities are lumped with high priorities for execution in a single project. Practical difficulties could be foreseen as this approach was attempted:

- Computing realistic net present values (savings) of benefits resulting from correcting the component hazards at various assumed future time periods would require new guidelines. Standardizing a broad spectrum of hazards/correction values (the "cook book" approach) would probably be necessary, controversial, and take many months of effort.
- Optimization could be for: (1) each activity's projects, (2) sub and major claimant projects as a group, or (3) the entire NAVOSH program taken year-by-year over several years. Selecting the optimal option could require an enormous effort in interactively evaluating the projects (or even the alternatives) for many assumed optional groupings.

Considering the uncertainties in the predicted values of the inputs, coupled with the potentially great optimizing effort likely to be required, the approach of deriving a composite cost effectiveness expression for combination NAVOSH projects was rejected as impractical.

A more direct and much simpler approach was then investigated. This method could assess the relative merit of combining projects using only information likely to be readily available in supporting data provided by the submitting activity with each project request. We experimented with various procedures for calculating a composite priority index for each project in a direct fashion. These procedures depended on the assumption that the project as submitted

represented the most operationally acceptable grouping of work items from the viewpoint of activity and the claimant. We reasoned that each separate work item could be scored by the hazard assessment procedure of the prototype priority method. We might then separately "average" the risk assessment codes, the corrective action assessment codes, and the facility assessment codes. The result would be an "averaged" 3-digit assessment index for the combination project, useful for comparing priorities among combination projects and also for setting priorities among all projects.

This simple procedure was tried on the data available for several recently proposed combination projects. In experimenting with these calculations, we observed that NAVOSH combination projects on file were of three general types:

Type 1 -- Multiple categories of hazards in a single facility
Type 2 -- Single category hazards in multiple facilities
Type 3 -- Multiple categories of hazards in multiple facilities.

When hazards in the Type 1 projects were well defined and the basic data items complete, we had no trouble calculating the "average indices." Calculating Type 2 project indices also gave no problems when all data were available. But Type 3 projects required additional steps to produce a single 3 digit code, e.g., sorting into Type 1 or Type 2 projects, averaging each type separately, then "averaging" the "averages." Table 13 illustrates these calculations.

Two important observations were made while experimenting with ways to deal with combination projects and calculating their hazard assessment codes. We found that:

Table 13
EXAMPLES OF AVERAGE HAZARD ASSESSMENT CODE (HAC)
CALCULATIONS FOR COMBINATION PROJECTS

Example 1: Type 1--Multiple Categories of Safety Hazards in a Single Facility

Hazard	HAC (Three Elements)		
Category A	2	1	4
D	1	2	3
E	2	2	3
Total (Each Element)	5	5	10
"Average Code" for the Project	2	3	3 (Each element rounded up)

Example 2: Type 2--Single Category of Health Hazard in Multiple Facilities

Facility	HAC (Three Elements)		
X	1	1	3
Y	2	1	2
Z	1	3	3
W	3	1	1
Total	7	6	9
"Average Code" for the Project	2	2	2

Example 3: Type 3--Multiple Categories of Hazards in Multiple Facilities.

1. Construct Matrix of Combinations, e.g.;

Hazard	Facility X	Facility Y	Facility Z	Facility W
A	AX	--	AZ	AW
D	--	DY	DZ	--
E	EX	--	--	EW

2. Separate into 3 Type 2 Projects:

a.

Hazard A in	HAC Elements		
X	2	2	2
Y	-	-	-
Z	1	2	1
W	3	1	2
Ave	2	2	2

b.

Hazard D in			
X	-	-	-
Y	4	2	2
Z	2	1	1
W	-	-	-
Ave	3	2	2

c.

Hazard E in			
X	1	1	1
Y	-	-	-
Z	-	-	-
W	2	2	3
Ave	2	2	2

3. Reduce a. b. and c. to "Average of Averages" for the project:

Final Score	2	2	2

- Justification on a cost saving basis for Type 3 combination projects may be difficult or impossible.

- Categories of hazards need to be clarified and standardized before they can be used in defining the hazard types in combination projects.

It is not clear whether Type 3 projects can be justified. Unless the costing is detailed and has a smaller margin of error than is the present practice for preliminary stages in project preparation, we found that it was generally impossible to show valid significant potential cost savings resulting from executing a Type 3 project instead of executing several Type 1 or Type 2 projects as options.

To examine the problem of standardizing hazards for use in addressing combination projects, SRI reviewed OSH standards based on subparts of CFR Title 29, Part 1910. A list of hazard classes we believed to be easily recognized and comprehensive was abstracted. Through consultation with NAVFAC and Chief of Naval Material (CNM) personnel, agreement was reached on the categories shown in Table 14.

4. Inputs from Operating Personnel

To gain more thorough insights into the whole process of NAVOSH MCON project request generation and to test our theoretical approaches to dealing with life cycle costing, OSH relevance, and combination projects in the priority method, SRI took its questions to the field. Selected commands and activities were visited to collect opinions and information from engineers, planners, and program managers responsible for NAVOSH project initiation and administration.

Personal visits by SRI team members to discuss the NAVOSH priority system in its prototype form and possible ways of improving it or expanding its use are listed in Table 15. Constructive comments were obtained during these visits concerning the overall NAVOSH program and how the priority system could eventually benefit individual commands.

Table 14
NAVOSH DEFICIENCY ABATEMENT CATEGORIES

Category	Title
1	Walking/Working Surfaces o Floor and wall openings and holes o Stairways o Ladders o Scaffolding o Railings
2	Means of Egress o Exit doors o Exit signs o Directional exit signs o Emergency lighting
3	Powered Platforms o Vehicle-mounted elevating and rotating work platforms
4	Ventilation (to reduce airborne concentrations of toxic or hazardous materials) o Abrasive blasting o Grinding, polishing, and buff operations o Spray-painting operations o Open surface tanks o Maintenance garages (car, heavy equipment, locomotive) o Laboratory hoods o Welding, cutting, brazing operations o Other
5	Noise Exposure o Continuous o Impact
6	Ionizing Radiation o Alpha, Beta, Gamma, Neutrons o X-rays
7	Non-Ionizing Radiation o Lasers o Microwave o Radio frequency
8	Compressed Gases o Storage/Use - Acetylene - Hydrogen - Oxygen - Chlorine - Other

Table 14 (Concluded)
NAVOSH DEFICIENCY ABATEMENT CATEGORIES

Category	Title
9	Flammable and Combustible Liquids o Tank Storage o Container or portable tank storage o Spray finishing with flammable and combustible liquids o Dip tanks containing flammable and combustible liquids o Storage of LPG
10	Sanitation o Water supply o Toilet facilities o Showers o Change rooms o Food service
11	Materials Handling o Powered industrial trucks o Overhead and gantry cranes o Crawler, locomotive and truck cranes o Derricks
12	Machine Guarding o Metal working machinery o Woodworking machinery o Abrasive wheel machinery o Mechanical power presses o Mechanical power-transmission apparatus
13	Portable Powered Equipment o Guarding of Portable Powered Tools
14	Welding, Cutting, and Brazing (except ventilation for) o Installation of oxygen-fuel gas system for welding and cutting o Manifold cylinders o Installation of welding and cutting equipment
15	Electrical o Installation of upgraded system, i.e. circuit breaker panel, heavier gauge wire, GFI o Installation of new system o Correct explosion-proof wiring violations
16	Diving Facilities
17	Warning Devices o Alarms o Signs o Lights o Color Coding
18	Mechanical and First Aid o Emergency eyewash/shower

Table 15

PERSONS CONTACTED DURING FIELD VISITS
June - September 1980

1.	Bob Isaacson	NAVSUP
2.	Ron Daley	CNM
3.	Carl Mandler	WESTDIV
4.	Lcdr. Aksiorczyk	NSC, Staff Civ. Eng.
5.	Robert Brandt	Head, Fac. Planning PWC, San Francisco
6.	Shaw Chang	PWC, San Francisco
7.	Ron Davis	PWC, San Francisco
8.	Jim Vickers	LANT DIV PLANS
9.	Jay Hart	LANT DIV PLANS
10.	Dan Reinhard	SECNAV
11.	Dave Anderson	NAVAIR
12.	Paul Raftus	NSC
13.	Matt Rosa	Safety Dir NARF
14.	Chas. Bourdon	NAV OCEAN CNTR
15.	Leo Miranda	Planner NARF
16.	Capt. Markham	CNM
17.	Robert Heckler	CNM
18.	Ed Kratovil	CNM

In general, the priority system as introduced in March 1980 by OP45 was well received and complete data were being provided for new projects requesting O&MN funds. For the time being, however, no attempt was being made to update projects previously submitted to include the basic priority data because of personnel shortages.

Specific comments shown in Table 16 were received regarding MCON project preparation, life cycle costing, ORV, and other procedures for assessing the priority of combination projects.

Table 16
COMMENTS RECEIVED CONCERNING SUGGESTED PROCEDURES
FOR USING SRI's PRIORITY METHOD WITH MCON PROJECT REQUESTS

- Thresholds qualifying projects for O&MN or MCON funding need clarification. Tables C-1, C-2, and C-3 of OPNAVINST 11010.20D (8 Mar 1979) could be modified to include NAVFAC centralized funding of NAVOSH.

- Detailed life cycle costing for Form 1391 and completion of the facility plan require too much effort for first submission of request. Simplified rules for costing first submission are needed.

- OSH must be balanced with basic facility requirements. More involvement of planning personnel should be sought in early stages of project preparation.

- Definition of "Effectiveness of Corrective Action" should be revised in SRI's draft procedures. In cases where standards are given, the corrective action must only meet the standard. "Effectiveness," therefore, should have a special meaning related to the abatement standard or threshold, not simply to the degree of hazard reduction. No more credit is given to a project that reduces the hazard below the standard than is given to one that just meets the standard.

5. Procedures Recommended

On the basis of these discussions, SRI recommended that NAVFAC consider adopting the procedures shown in Table 17 for dealing with combination projects in the NAVOSH priority method.

Table 17

RULES FOR COMBINATION MCON PROJECTS

Number of Facilities Included	Number of Hazards Included: Single Category	Number of Hazards Included: Multiple Categories
Single	OK - single OCR	OK - one OCR section 12 for each category. Calculate average HAC for project.
Multiple	OK - one OCR section 12 for each facility Calculate average exposure and concentration to obtain a single HAC for project.	Not acceptable. Separate into two or more projects

Other recommendations to facilitate NAVOSH planning, programming, and budgeting are shown in Tables 18 and Figure 5. Table 18 clarifies the threshold levels, the documentation required, and the appropriate source of funding. Figure 5 indicates steps and associated criteria SRI recommends for use in the preparation and review of all NAVOSH project requests. The criteria indicated on Figure 5 are given in Table 19.

Table 18

SUMMARY OF PROGRAMMING REQUIREMENTS FOR NAVOSH DEFICIENCY ABATEMENT PROJECTS

CATEGORIES OF WORK[1]	COST LIMITS	APPROPRIATION	INITIAL PROJECT FORMAT	SUBMIT TO	VIA	FUND SOURCE	FOLLOW-UP DOCUMENTS	PRIORITIZATION METHOD[3]
	REGULAR AND RESERVE ACTIVITIES							
Construction	0-15K	O&MN	None	None		Activity	None	RAC
	15K-100K	O&MN	OCR	Major claimant	Chain of command	NAVFAC	9-11014/64	HCA
	Over 100K	MCON	OCR & 11000/4	Major claimant	Chain of command and EFD	NAVFAC	1391	HCA
Repair and Maintenance	0-25K	O&MN	None	None		Activity	None	RAC
	Over 25K	O&MN	OCR	Major claimant	Chain of command	NAVFAC	9-11014/64	HCA
Equipment Installation	0-10K	O&MN	None	None		Activity	None	RAC
	Over 10K	O&MN	OCR	Major claimant	Chain of command	NAVFAC	9-11014/64	HCA
Equipment Procurement[2]	0-3K	O&MN	None	None		Activity	None	RAC
	Over 3K	OPN	OCR	Major claimant	Chain of command	NAVFAC	None	HCA
	PRODUCTION FACILITIES - NIF/MODIFIED NIF							
Construction	0-15K	O&MN	Varies with claimant			Activity	None	RAC
	15K-100K	O&MN	OCR	Major claimant	Chain of command	NAVFAC	9-11014/64	HCA
	Over 100K	MCON	OCR & 11000/4	Major claimant	Chain of command and EFD	NAVFAC	1391	HCA
Alterations[4]	0-25K	(NIF)	None	None		Overhead	None	RAC
	25K-100K	(NIF)	9-11014/64	Major claimant	Chain of command	Overhead	None	HCA
	Over 100K	MCON	OCR & 11000/4	Major claimant	Chain of command and EFD	NAVFAC	1391	HCA
Repair and Maintenance	0-25K	(NIF)	None	None		Overhead	None	RAC
	Over 25K	(NIF)	None	None		Overhead	None	RAC
Equipment Installation[5]	0-10K	(6)	None	None		(6)	None	RAC
	Over 10K	(6)	9-11014/64	Major claimant	Chain of command	(6)	None	HCA
Equipment Procurement[2]	0-5K	(NIF)	None	None		Overhead	None	RAC
	Over 5K	OPN	OCR	Major claimant	Chain of command	NAVFAC	None	HCA

(1) As defined in OPNAVINST 11010-20.

(2) Refers to movable equipment as opposed to installed equipment.

(3) RAC refers to Risk Assessment Code; HCA refers to the more sophisticated Hazard Control Assessment of prioritization as described in OPNAVINST 5100.23.

(4) Alterations over 15K at NIF activities can also be funded using the construction procedures for regular activities.

(5) Equipment installations over 10K where the equipment unit cost is greater than 5K at NIF activities, can also be funded using the equipment installation procedure for regular activities.

(6) When the equipment unit cost is over 5K, the installation shall be funded from the operations appropriation providing military support to the activity, except those items purchased under the industrial and productivity enhancement/fast payback program. When the equipment unit cost is 5K or less, the installation may be funded from the activity overhead account.

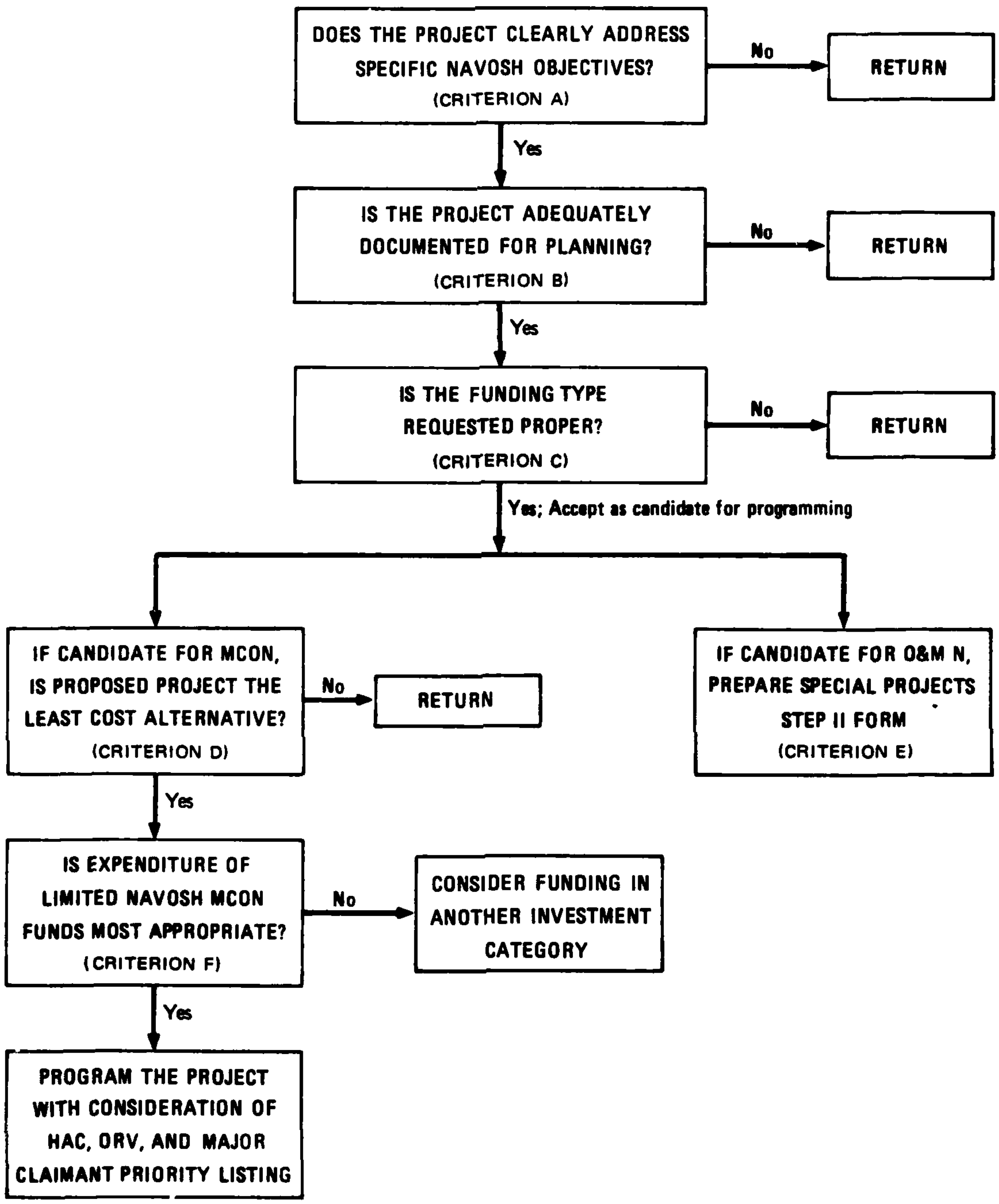

FIGURE 5. STEPS AND CRITERIA IN THE PREPARATION AND REVIEW OF NAVOSH PROJECTS REQUESTS

Table 19

RECOMMENDED CRITERIA
(for use with Figure 5)

Criterion A	Specific OSH deficiencies must be cited: hazard(s) must be result of facility design inadequacy or the result of a new OSH standard--not the result of normal wear and tear.
Criterion B	All projects must have a completed OCR form. MCON projects must have Form 11000/4 in addition to OCR; Form 1391 is not required for initial project submission. An O&MN project must address a single categorical deficiency. See Table 1 for List of NAVOSH categories of deficiencies. An MCON project may be submitted for correction of deficiencies in one or more categories in "combined projects." See Special Instructions below for combination projects.
Criterion C	Dollar thresholds and ceilings must be satisfied; proper funding appropriation indicated. See Table 2. Major claimant assigns his priority.
Criterion D	Detailed life cycle costing material prepared for each alternative is reviewed to support least cost choice. This material will be used in subsequent preparation of Forms 1391 and 1391c if project is approved for programming.
Criterion E	Special Project Step II forms are not required for initial submission of the project. Once accepted as a candidate project, Step II forms will be requested.
Criterion F	OSH relevancy value (ORV) is required on MCON projects. The ORV is a decision factor based on weighted project costs by types of construction cost; i.e., direct costs, supporting costs, and other costs. See instructions below (paragraph C) for method of calculating the ORV.

Figure 5 is compatible with Figures 6 and 7 developed by NAVFAC and promulgated in February 1980 as guidelines for NAVOSH project preparation.

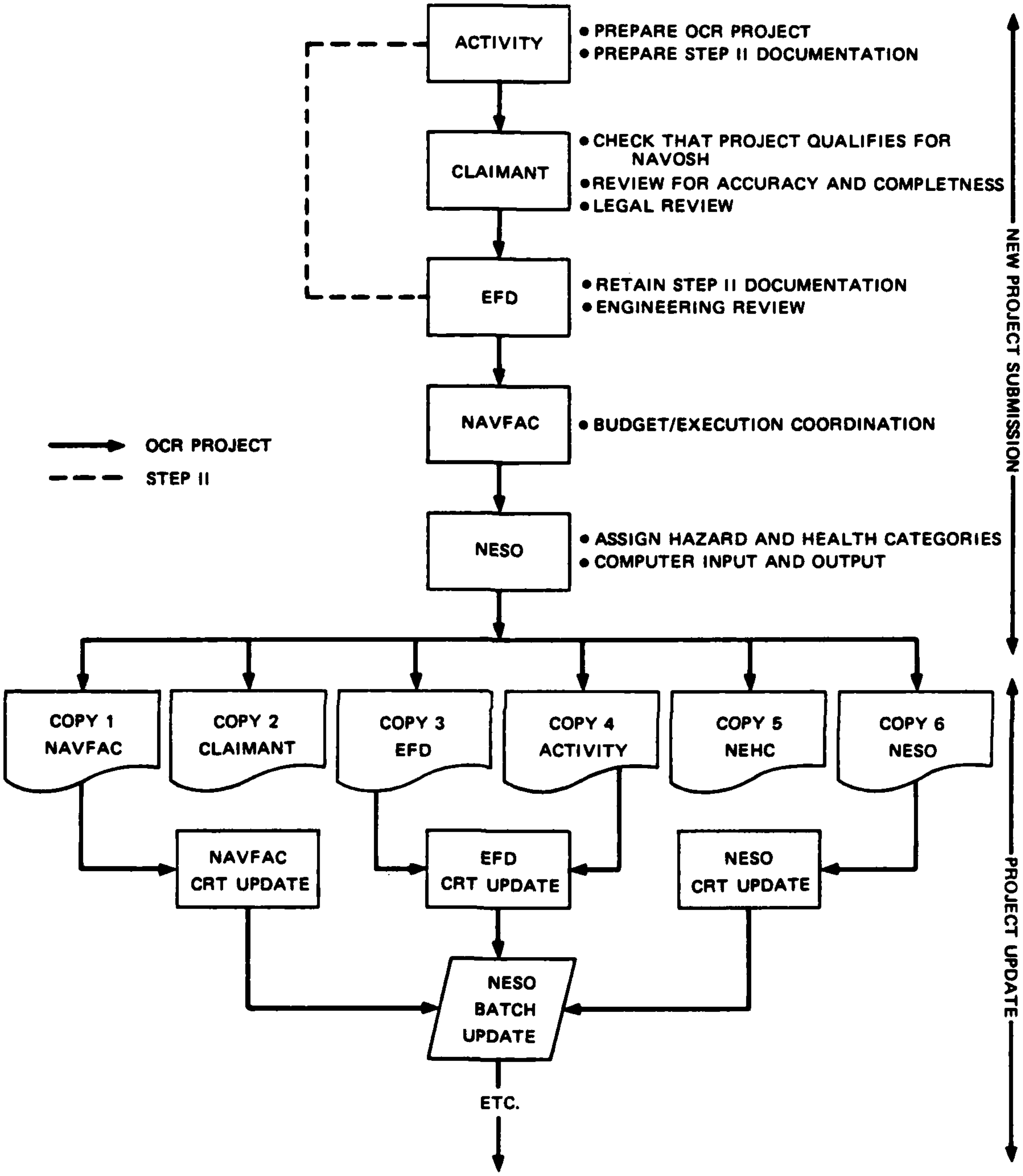

FIGURE 6. NAVOSH DEFICIENCY ABATEMENT (O&MN, OPN) PROJECT FLOW

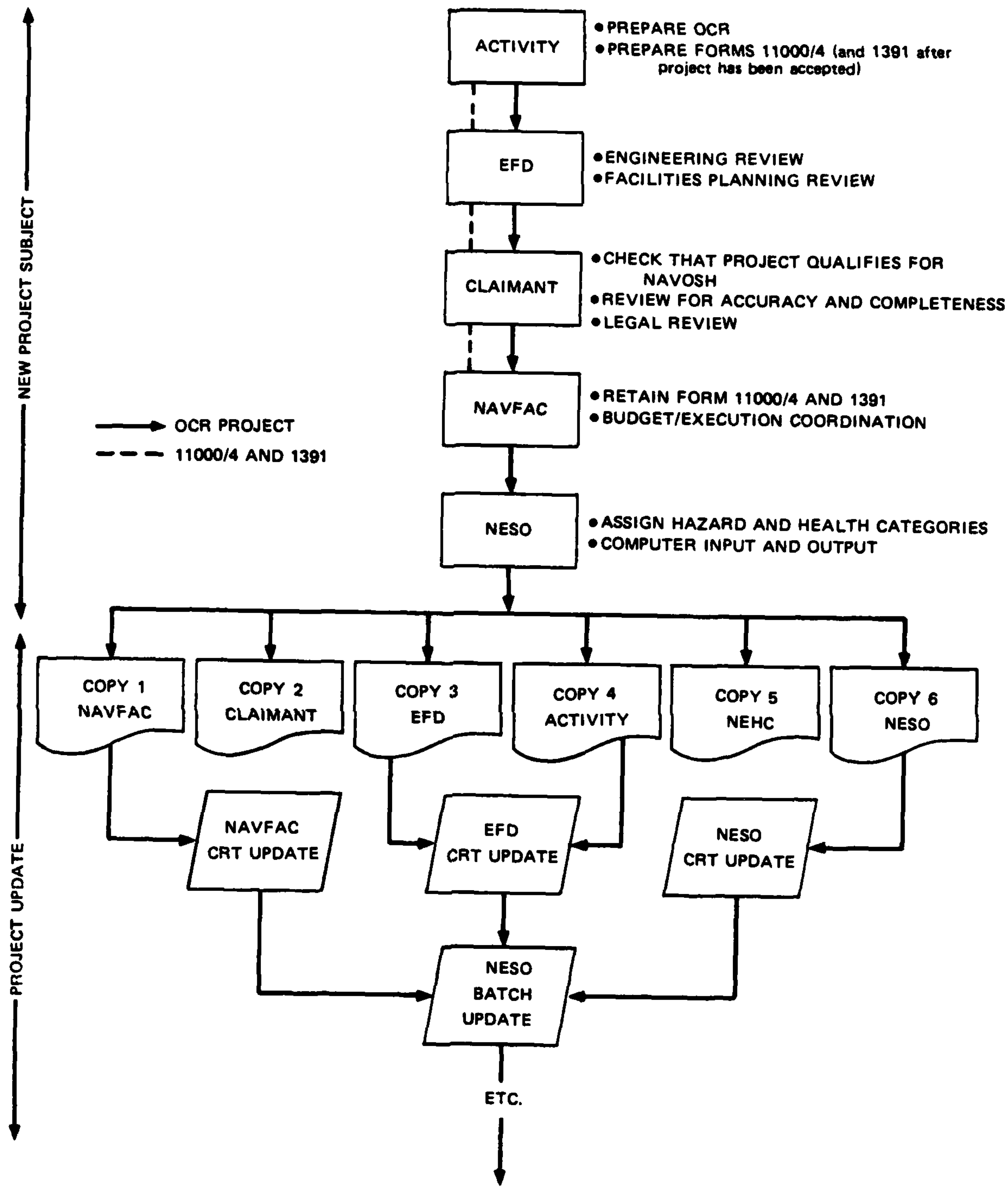

FIGURE 7. NAVOSH DEFICIENCY ABATEMENT (MCON) PROJECT FLOW

III RESULTS OF THE FIRST OPERATIONAL USE OF THE PRIORITY METHOD

A meeting of major claimants was called by the Chief of Naval Operations (OP45) in February 1980 to provide an overview of the NAVOSH program, including the OCR and the prototype NAVOSH priority system developed by SRI. At this meeting OP45 announced that the priority system would become operational for its intial trial during FY 1981. Major claimants were requested to begin implementing all elements of NAVOSH hazard abatement and to assist their activities in using the OCR format for new project requests.

Immediately after the February meeting, NESO took steps to develop the OCR data management and reporting system so that NAVOSH projects could be compiled in the computerized system by September 1980. SRI was notified that it would be furnished a copy of the OCR for analysis. Under Phase II of the priority method research, SRI was given the task of assessing how successfully the method was being implemented.

The first full OCR was received at SRI in January 1981. More than 300 NAVOSH O&MN/OPN projects were recorded in the OCR format. As designed, section 13 of the format contained over 20 items of information that could demonstrate the functioning of the priority method during an operational cycle.

NESO personnel responsible for the OCR stated that this first report was an interim document consolidating all available information on old and new O&MN and OPN projects as of January 1981; by summer of 1981, all projects should include complete data. Also, it was reported that for the FY 1982 program MCON projects would be added and O&MN and OPN projects would be updated. NAVFAC was planning a meeting of EFDs in

April 1981 to discuss the status of the NAVOSH program and to issue additional detailed instructions regarding preparation of project requests.

A. Composition of the January 1981 OCR

In the computer printout OCR projects were grouped by hazard type, as either health or safety projects. This first report contained 114 health related projects and 188 safety projects, a total of 302. Of the 114 health projects, only 13 contained completed priority data; i.e., section 13s. However, of 188 safety projects, 59 included completed priority assessments. Table 20 shows selected data from each of the projects in the OCR that contained priority codes.

B. Analysis of the Priority Method as an Aid to Decision Making

NAVOSH program procedures require major claimants to rank their projects in their order of preference or priority. Final consolidation of claimant ranked projects into a single list of projects recommended for funding is made by NAVFAC in carrying out its responsibilities of central management of the abatement portion of the NAVOSH program.

The priority method as developed by SRI was designed to be used by claimants and NAVFAC to group projects by relative merit on a uniform and systematic basis. All NAVOSH projects competing for O&MN or MCON funds would be automatically labeled with a relative priority score derived from basic data entered into the matrices. The resulting HAC score would indicate the priority group in which the project belonged. Because the SRI priority method takes into account many of the risk, cost, and utility factors likely to be considered by the claimants and NAVFAC in judging priorities, we expected the HAC groupings to contribute significantly to the systematic, consistent ranking of projects by claimants and NAVFAC.

Table 20

SELECTED DATA FROM OCR
Dated 15 Jan 1981
Project Type - O&MN and OPN

HAZARD TYPE -- HEALTH

Serial No.	Hazard Cited	HAC	Activity/Claimant	Requested Start	Total Requested $Amount (000)/ Appropriation
H185A[a]	Carbon Monoxide	121	PWC GR. LAKES/NAVFAC	FY 80	56/O&MN (8)[b]
H192A	Asbestos (Survey)	221	CNO/CNO	FY 79	386/O&MN (386)
H225A	Carbon Monoxide	111	PMTC/NAVAR	FY 81	40/O&MN
H227A	Asbestos (Change Room)	411	PWC GR. LAKES/NAVFAC	FY 78	20/OPN (20)
H228A[a]	Noise	231	NSC OAK/NAVSUP	FY 81	87/O&MN (5)
H232A	Noise	231	COMM. STA. GUAM/NAVTEL	UP	75/O&MN
H236A	Pesticide Vapors	231	PWC GUAM/NAVFAC	UP	97/O&MN
H237A	Fumes	211	PWC GUAM/NARVAC	UP	8/OPN
H238A	Mercury	224	SRF YOKO/PACFLT	UP	29/O&MN
H241A	RF Radiation	221	ELEC SY CMD DC/NAVELEX	UP	300/OPN
H249A	Noise	211	TRA CNTR NEWPORT/CNET	FY 81	22/OPN
H282A	Welding Fumes	111	PWC S.D./NAFVAC	FY 81	10/O&MN
H284A	Noise	311	NARF CHERRY PT./NAVAIR	UP	33/OPN

HAZARD TYPE - SAFETY

Serial No.	Hazard Cited	HAC	Activity/Claimant	Requested Start	Total Requested $Amount (000)/ Appropriation
Y017A	Emerg. Lighting	311	HCS BREM/NAVSUP	79	60/O&MN (60)
Y172A	Elec. Shock	212	WPC GR. LK/NAVFAC	UP	20/O&MN
Y173A	Flam. Liquids	112	PWC. GR. LK/NAVFAC	UP	22/O&MN
Y243A	Flam. Liquids	211	PWC GR.LK/NAVFAC	80	3/O&MN
Y261A	Unguarded Mach.	111	NSC OAK./NAVSUP	80	57/OPN
Y262A	Unguarded Mach.	211	NSC OAK./NAVSUP	80	80/OPN
Y288A	Paper Cutter	211	DEF. PUB. SERV./NAVSUP	90	31/OPN
Y289A	Elevator Cables	231	COMM. STA. HA./NAVTEL	80	359/O&MN (29)
Y290A	Falling (Ladder)	321	NSC CHAS./NAVSUP	81	83/O&MN
Y291A	Emerg. Exits	121	NSC CHAS./NAVSUP	81	95/O&MN
Y292A	Haz. Mat (No Showers)	221	NSC CHAS./NAVSUP	81	51/O&MN
Y293A	Elec. shock	231	NSC CHAS./NAVSUP	81	88/O&MN
Y294A	Toxic Fumes	132	PMTC MUGU/NAVAIR	81	176/O&MN
Y296A	Material Storage	311	NSC S.D./NAVSUP	81	32/O&MN
Y297A	Unsafe Ladders	322	SPCC MECH./NAVSUP	81	18/O&MN
Y298A	Battery Gases	111	COMMISS. STORES. GR/NAVSUP	81	28/O&MN
Y299A	Emerg. Exit (Illum.)	331	PWC GR. LK./NAVFAC	81	23/O&MN
Y300A	Smoke (Alarms)	111	Res. Cntr. Phoen./CNAVRES	81	35/O&MN
Y301A	Fire (Alarm)	121	NSC/NORF/NAVSUP	81	99/O&MN
Y302A	Wharf (Curbing)	111	NSC HAW./NAVSUP	UP	20/O&MN
Y303A	Batt. Acid (Fumes)	321	NSC HAW./NAVSUP	UP	60/O&MN
Y304A	Fire (Alarms)	121	NSC HAW./NAVSUP	UP	94/O&MN

[a] See Appendix D for complete OCR.

[b] Amount funded for FY '81 is shown in parentheses.

Table 20 (concluded)

HAZARD TYPE - SAFETY

Serial No.	Hazard Cited	HAC	Activity/Claimant	Requested Start	Total Requested $Amount (000)/ Appropriation
Y305A	Emerg. Exits	111	NSC HAW./NAVSUP	UP	34/O&MN
Y306A	Emerg. Exits	111	NSC HAW./NAVSUP	UP	27/O&MN
Y307A	Elec. Shock	243	SPCC MECH/NAVSUP	81	71/O&MN
Y308A	Falling (Railings)	213	NARF NORF/NAVAIR	81	32/O&MN
Y310A	Haz. Mat. Store	311	NCB L. CR./LANTFLT	81	30/O&MN
Y311A	Toxic/Explo. Gas	111	PWC GUAM/NAVFAC	UP	10/O&MN
Y312A	Unsafe Platform	111	PWC Guam/NAVFAC	UP	9/O&MN
Y313A	Unsafe Dock	211	COMM STORES TN./NAVSUP	81	33O&MN
Y314A	Walking Surfaces	111	PWC PENSA./NAVFAC	81	16/O&MN
Y315Aa	Crane	131	NAS BARB/PACFLT	UP	96/O&MN
Y316A	Haz. Mat	111	NAS BARB/PACFLT	UP	26/O&MN
Y317A	Lightning	111	MAGAZINE GUAM/PACFLT	UP	35/O&MN
Y318A	Lightning	211	MAGAZINE GUAM/PACFLT	UP	29/O&MN
Y319A	Lightning	211	MAGAZINE GUAM/PACFLT	UP	50/O&MN
Y320A	Lightning	111	MAGAZINE GUAM/PACFLT	UP	35/O&MN
Y321A	Lightning	211	MAGAZINE GUAM/PACFLT	UP	48/O&MN
Y322Aa	Paper Cutter	111	DEF. PRINT SER./NAVSUP	UP	49/OPN
Y323A	Paper Cutter	111	DEF. PRINT SER./NAVSUP	UP	40/OPN
Y324A	Paper Cutter	211	DEF. PRINT SER./NAVSUP	UP	55/OPN
Y325A	Paper Cutter	111	DEF. PRINT SER./NAVSUP	UP	--/OPN
Y326A	Paper Cutter	111	DEF. PRINT SER./NAVSUP	UP	--/OPN
Y327A	Paper Cutter	111	DEF. PRINT SER./NAVSUP	UP	--/OPN
Y328A	High Voltage	411	NAS BRUNSWICK/LANTFLT	81	43/O&MN
Y329A	Falling (Ladder)	311	NSC BREM/NAVSUP	81	22/O&MN
Y330A	Falling (Catwalk)	211	COMM STA STOCK/NAVTEL	81	65/O&MN (65)
Y331A	Crane	211	PWC S.D./NAVFAC	81	50/O&MN
Y332A	Walking Surface	311	NAS S.D./PACFLT	81	25/O&MN
Y333A	Haz. Flam. Store	222	CBC PTH./NAVFAC	81	43/O&MN
Y334A	Crane	131	NAS BARB./PACFLT	UP	127/O&MN
Y335A	Crane	131	NAS BARB./PACFLT	UP	27/O&MN
Y336A	Battery Fumes	313	NAS/S.D. PACFLT	81	39/O&MN
Y337A	Falling Ceiling	131	NAS S.D./PACFLT	81	80/O&MN
Y380A	Fire (Doors)	231	PHIBBASE COR/PACFLT	81	38/O&MN
Y383A	Crane	111	PWC NORF/NAVFAC	UP	12/O&MN
Y384A	Battery Fumes	113	AIRFAC MISAWA/PACFLT	UP	39/O&MN
Y385A	Exp. Gas Store	111	NSC CHAS./NAVSUP	UP	20/O&MN
Y396A	Elec. Shock	111	AV SUP PHILA/NAVSUP	UP	36/O&MN

Needless to say, when the majority of the priority data are missing from projects in the initial OCR--and hence, HAC code groupings are incomplete--the utility of the priority method for the claimants and NAVFAC is mostly lost. However, if we can assume that the 72 projects scored in this OCR are a representative sample of the kinds of projects likely to be submitted, then observations concerning the groupings and the coded scores may be useful in evaluating whether the priority system is likely to be capable of performing its designated functions as a decision tool.

1. Distribution by Coded Groups

Table 20 shows that the 72 projects are clustered into the 20 separate HAC Code groups given in Table 21. On the basis of our early tests (Page 67), we expected the priority system, when functioning properly, to spread NAVOSH projects among 15 or more groups. The spread of 72 projects into 20 groups appeared satisfactory. We thought that the proportion of projects in each group might be somewhat uniform, but this did not happen in this sample. As Table 21 shows, the code group 111 (the highest priority ranking code in the system) is dominant. This may reflect a conscious bias on the part of activities to select those projects for submission that they consider most urgent.

Other groups containing relatively large numbers of projects are codes 211 and 311. A possible meaning of these secondary clusters is that as the risk assessment data items assume lesser importance in the eyes of the originator, the corrective action data items are given compensating values to keep the rating as high as possible. If this happens, the score of the project is biased toward the index X11. Without field analyses to examine these projects, the presence of such bias remains hypothetical.

Table 21

CLUSTERS OF HAC CODES

Rank	Code Group	Number of Projects	H	Y
1	111	21	2	19
2	112	1		1
3	113	1		1
4	121	4	1	3
5	131	4		4
6	132	1		1
7	211	13	2	11
8	212	1		1
9	213	1		1
10	221	3	2	1
11	222	1		1
12	224	1	1	
13	231	6	3	3
14	243	1		1
15	311	6	1	5
16	313	1		1
17	321	2		2
18	322	1		1
19	331	1		1
20	411	2	1	1
		72	13	59

2. Distribution of Code Groups By Hazard Class

We examined Table 20 with respect to the health or safety make-up of its clusters. Table 21 also shows these data. It was obvious that for this sample, the number of safety projects in a hazard group controlled the character of the distribution of the codes. We observed, however, that this sample of 72 was weighted more heavily with safety projects (59 out of 72 or 82%) than the full list of 301 (188 out of 302 or 62%). If the proportion of health and safety projects had been more nearly equal, the character of the distribution might have been different.

3. Connection Between the HAC and the Hazard

We examined the possibility that a connection existed between the HAC code and the type of hazard within a class (See Table 22). No particular pattern was found--e.g., "carbon monoxide" appeared in several different codes as did "fall," "electric shock," and many others in the list of 23 hazard types. (Mechanized "paper cutters" might be an exception; four of seven examples appeared in code 111, with the other three in 211.) We theorized that because of the highly variable site-specific operating conditions, such connections should be at a minimum in a successful priority system.

C. Overall Assessment of First Results

We had anticipated having an opportunity to evaluate the operability of the priority method on the basis of a fully complete OCR. For reasons of practical limitations on time and resources available at activities, EFDs, and NESO, and to some extent because detailed implementation instructions were being revised at NAVFAC, we were not afforded this chance. Our analyses of the data available gave no indications that the priority method needed changing at this time. On the contrary, the general concept appears feasible, at least for O&MN

Table 22

CODE GROUP BY HAZARD TYPE

Hazard Type	Code Group	No. Projects
1. Carbon Monoxide	111	1
	121	1
2. Welding Fumes	111	1
3. Unguarded Machinery	111	1
	211	1
4. Battery Acid/Fumes	111	1
	113	1
	313	1
	321	1
5. Smoke (No Alarms)	111	1
	121	2
6. Wharf/Dock	111	1
	211	1
7. Emergency Exits	111	2
	121	1
8. Toxic Gas	111	1
	131	1
	211	1
9. Unsafe Platform/Fall	111	1
	211	1
	213	1
	311	1
	321	1
	322	1
10. Walking Surfaces	111	1
	311	1

Table 22 (Concluded)

CODE GROUP BY HAZARD TYPE

Hazard Type	Code Group	No. Projects
11. Hazardous Material Storage	111	1
	112	1
	211	1
	221	1
	222	1
	231	1
	311	2
12. Lightning	111	2
	211	3
13. Paper Cutter	111	4
	211	3
14. Crane	111	1
	131	3
	211	1
15. Explosive Gas	111	1
16. Electric Shock	111	1
	212	1
	231	2
	243	1
	411	1
17. Noise	211	1
	231	2
	311	1
18. Falling Ceiling	131	1
19. Asbestos	221	1
	411	1
20. RF Radiation	221	1
21. Mercury	224	1
22. Emergency Lighting	311	1
	331	1
23. Fire Doors	231	1

and OPN project scoring. Analysis of the more complex MCON projects may reveal a need for change as the rules for dealing with combination projects are tested in projects included in the complete OCR next summer. We suggest that a second analysis of the priority method be made when all data are available and after the utility of the system for aiding in project ranking and funding is tested in the FY 1982 program.

IV CONCLUSIONS AND RECOMMENDATIONS FOR THE FUTURE

A. Conclusions

In general, based on the trial results available to date, we conclude that the priority method developed by SRI in this research meets NAVFAC design requirements. Specifically, it enables NAVOSH project requests to be systematically rated in terms of three factors: the risk of the hazard; the dollar efficiency of abatement; and the need to continue the operation involving the hazard as a function of the requesting activity's mission. Processing originator data, the method produces a separate score for each of these factors for every project. The scores, displayed as a code group, identify the project as belonging in a group. The relative priority among groups is determined according to a simple rule of precedence (111; 112--115, 121--125, 211; and so forth).

Note that this method rates all projects within a given code group as equal in priority. This may be of special interest, depending on how NAVFAC chooses to employ the method in the final selection of projects for funding. We assume that project funds requested will be computed cumulatively by groups in order of rank. The budget threshold will most likely fall on one of the groups.

One way NAFVAC might choose to proceed would be to fund all projects in groups above the threshold group, postponing or rejecting all below that group, and selecting some projects from the threshold group to fill the budget on the basis of claimant special needs, political considerations, or other contingencies. An alternative and possibly better programming strategy might be to choose a program cutoff above the threshold group, assuming, of course, that the group is

relatively small.[a] This would allow for minor adjustment of the current year budget during the year.

Use of the priority method for MCON project selection will be significantly more complicated because combination projects are included in the project mix. The use of "averaged indices" and "mixed ORVs" as suggested in this report has not been operationally tested, although it has been discussed with operating personnel and field tested on a limited basis. At this time we conclude that the basic concept of the priority method is applicable to MCON programming, but it may require a considerable amount of training and perhaps some modification before it is univerally accepted by project originators.

We recognize that the Navy has many years of experience predating OSHA in setting and implementing workplace safety and health rules, particularly safety rules. Considering the many varied industrial functions its activities perform in support of fleet units, its NAVOSH program will continue to be comprehensive. As the nation's attention turns to increased worker protection, setting of appropriate threshold budgets and planning for outyears of NAVOSH will become increasingly dependent on good management and extensive recordkeeping. It is in the area of recordkeeping that the abatement program and its OCR will undoubtedly contribute major improvements over past Navy practices.

SRI experienced real difficulty at the beginning of this research in tracking the status or the progress of the OSH related projects among the Navy's distributed files. With the OCR and centralized management, there should be a dramatic improvement. If the computer management system programs are further developed, the OCR can produce an invaluable record of Navy OSH response activities.

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[a] From our sample distributions of code groups, it appears unlikely that the threshold group will be large.

Concerning the trend in OSH, until recent years the OSHA concentrated on safety, frequently being accused of nitpicking without concern for cost effectiveness. Now, within OSHA, the focus is on health hazards, especially on exposure to toxic chemicals. However, OSHA has yet to develop realistic standards and test procedures for more than a handful of health hazards out of hundreds of possibly serious ones. OSHA's task is formidable. It must deal with issues such as "economic and technological feasibility," "cost benefit proof of standards," "permanent, interim, and emergency standards"--all within the context of developing a "balance" between safety and health requirements.

Regardless of OSHA's difficulties in setting standards, legal challenges, and so forth, OSH will remain a prime management responsibility at all levels throughout the Navy. The yearly NAVOSH budget should be commensurate with the importance of this responsibility and should be managed in the most efficient manner possible. One sign of possible inefficiency we noted during our review of projects already submitted was the relatively few projects containing evidence that alternative corrective actions had been considered and evaluated. Even though DoD and Sec Nav prescribe secondary economic analyses (i.e., cost analysis of alternatives) for construction projects designed to upgrade facilities to meet standards, in most cases this requirement is dismissed with the statement, "There are no alternatives."[a] If we judge from the project records alone, we would conclude that the Navy's engineers and managers are lacking in ingenuity and innovation. We believe, instead, that this is an area where more management attention is needed to ensure that the priority method is screening candidate projects that have already been qualified and selected from project alternatives on the basis of their cost effectiveness.

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[a] This statement, it appears, is sometimes incorrectly made with the meaning, "There is no alternative to correcting the deficiency."

B. Recommendations

As a new program, NAVOSH appears to be getting off to a good start. To facilitate its further implementation and to improve the utility of the priority method, we recommend:

- Additional training on how the OCR is to be used, in particular training for EFD engineering and planning personnel.
- Further development of the computer programs for NAVOSH data management. Data analysis and special reports should be very useful to managers once they can be quickly and easily obtained.
- A detailed analysis of the priority method after OCR section 13s are complete for all projects, including MCON projects.
- A continuing research element in the NAVOSH program to identify OSH problems unique to the Navy, to analyze the need for change in hazardous operations and ways of mitigating or abating the hazards, and to estimate the size and focus of future Navy OSH budget requirements and to provide supporting documentation for them. Research findings in these areas could forecast the need for changes in the priority method well in advance of the operational need for such changes.

Appendix A

DIGEST OF RELEVANT PRIORITIZATION METHODS

This Appendix provides a brief description of prioritization methods reviewed during this research as listed in Section II.3d. More detailed descriptions of these methods, as well as citations of their sources, are given in "Methodology for Navy Occupational Safety and Health Analysis; Phase I: Current Techniques" (1979).

I. Methods

1. Cost-Benefit Fault Tree Analysis

Cost-benefit fault tree analysis, as applied to the NAVOSH program, would list the occupational accidents and illnesses (called events) and separate these events into mutally exclusive sets, grouped according to some common relationship. For each set, one must define a head event (i.e., an event encompassing all occupational accident and illnesses in the set) and construct a fault tree for the head event. By applying probability theory to the tree, the probability (P) that a head event (i) will occur is calculated (the user begins with the probabilities of occurrence of the causal events on the lowest level of the tree and works up the tree, combining probabilities as the tree indicates). For head event i, this probability is denoted P_i. If it is assumed that head event i occurs, one must determine the expected price[a] of the occupational accidents and illnesses in set i. This is called the expected price of head event i and is denoted U_i.

For each head event, the $P_i \times U_i$ price is calculated. To establish priorities for head events, these products are compared. The largest products indicate the head events most in need of abatement.

[a] "Price" is used here to mean total cost to the Navy that would result if the hazard went unabated. "Cost" refers to the requested to abate the hazard.

For each different abatement project being considered, one must calculate the expected price of the applicable head event and in addition the probability that the applicable head event will occur after the abatement project is completed. The cost of each abatement project must also be determined. (Abatement costs and the probability that the head event will occur must be calculated for the same unit of time or unit of production). The abatement measure of effectiveness, defined as the reduction in expected price of the head event resulting from the abatement project, is then calculated. The project cost effectiveness is defined as:

$$\frac{\text{cost of abatement}}{\text{abatement measure of effectiveness}}$$

These ratios can be used to compare all abatement projects; smaller ratios indicate greater effectiveness.

2. Cost-Benefit Type Methods

The term cost-benefit analysis and benefit-cost analysis are used interchangeably to refer to the method by which alternative actions for achieving a goal are systematically evaluated, quantified, and compared. Although the evaluation is usually expressed in dollars, other measures of value may be used (e.g. utility, or number of illnesses/injuries caused or prevented). When a benefit-cost evaluation has been made for each alternative, the alternatives can be compared using as the criterion either benefit minus cost or the ratio of benefit to cost.

Cost-effectiveness analysis, a term often used to denote cost-benefit analysis, can also refer to a similar analytical method in which no attempt is made to provide a scalar measurement for benefit. In this type of analysis, alternative actions are compared in terms of cost and various measurements of effectiveness.

3. Department of Defense Hazard Severity Risk Assessment Code Method

A survey is conducted in each workplace to identify occupational safety and health hazards. Each hazard is assessed in terms of hazard severity and mishap probability. As a result of this assessment, the hazard is assigned a risk assessment code that provides a means of establishing priorities for hazards according to their implied risk. OPNAVINST 5100.23 (1979) provides the table below for use in ranking the codes.

RISK ASSESSMENT CODE MATRIX

Hazard Severity	Mishap Probability			
	A	B	C	D
I	1	1	2	3
II	1	2	3	4
III	2	3	4	5

The hazard severity risk assessment is expressed by "Listing the hazard severity selected (e.g., II), then the mishap probability (e.g., A), to give the code as, for example, II.a. The priority rankings, 1, 2, ... 5, in the cells of the matrix are assigned by judgment of relative risk of the hazard. No standardized method or rationale is currently provided for arriving at the hazard severity or the mishap probability. Thus, the assessment is unsupported and can vary widely with the judgment and expertise of the assessor.

4. Expected Cost

The expected cost method compares the expected price of each hazard and the expected cost of measures for abating each proposed hazard to identify important hazards and feasible hazard abatement projects. The expected price of each hazard must be computed. To do this, one must establish a time period for consideration (t); list the types of accidents or illnesses expected to occur (number 1,2,...); determine the

number of occurrences of each accident and illness type expected ($E A_i$); and compute the cost of each type of accident and illness (C_i). The expected price of the hazard is then

$$C_i = \sum_i C_i E\left[A_i\right].$$

Hazards may be prioritized according to their expected price.

The expected cost of each proposed hazard abatement project must be computed also. For abatement project j, the total cost (TC_{jh}) equals the physical cost of the project (PC_j) plus the expected price of hazard h when project j has been implemented (EC_{jh}). A feasible abatement project is one whose total cost is less than the hazard price ($TC_{jh} \quad C_h$). An optimal abatement project minimizes total cost, and thus the most feasible is ($\min TC_{jh} \quad C_h$).

5. <u>Goal Programming</u>

Goal programming, as applied to the NAVOSH program, would develop a *mathematical model* of the Navy-wide occupational safety and health problem that incorporates:

- All the hazards
- The relationship of benefits to levels of hazard abatement
- The relationship of intensity and frequency of hazard exposure to occupational injury and illness
- The relationship between readiness and hazard abatement and occupational injury and illness.

For a given set of proposed NAVOSH projects, the mathematical model would be specialized to include only:

- Hazards addressed by these projects
- The relationship of benefit to the level of hazard abatement resulting from each project

- The relationship of intensity and frequency of hazard exposure to occupational injury and illness
- The costs incurred from occupational injury and illness
- The costs of each project.
- The relationship between readiness and hazard abatement and occupational injury and illness.

An equality or inequality has a higher priority than another if it is more important that it be satisfied. The goal programming solution technique ensures satisfaction of all higher priority equalities or inequalities before one of lower priority is satisfied. Equalities and inequalities represent such things as: acceptable total accident/illness frequency; OSHA compliance in each safety and health category, acceptable accident/illness cost per worker; and expected NAOVSH budget. The goal program might thus be used to investigate the impact of various OSH hazard abatement policies and measures.

6. Hazard Priorities (Number of Personnel Exposed x Severity)

For each hazard, the total number of personnel exposed (N) and the relative severity of the hazard (S) are estimated. The product N x S is then computed for each hazard. The larger the product is, the more important it is that the hazard be abated. Alternatively, in place of N one can substitute F, the frequency of injury.

By comparing the product of (N x S) or (F x S) expected when different abatement measures are applied, the applicability of the method can be extended to include an evaluation of abatement measures.

7. Modeling

Modeling, as applied to the NAVOSH program, would develop a Navy-wide model of occupational safety and health problems that is able to incorporate:

- All the hazards
- The relationship of benefits to levels of hazard abatement
- The relationship of intensity and frequency of hazard exposure to occupational injury and illness
- The costs of hazard abatement and of occupational injury and illness
- The changes in readiness resulting from hazard abatement and occupational injury and illness.

Modeling, then, investigates parametrically the costs, benefits, and impacts on Naval readiness resulting from varying OSH hazard abatement policies.

8. PATTERN

PATTERN (Planning Assistance Through Technical Evaluation of Relevance Numbers) was developed by the Military Products Division of Honeywell, Inc., to assist in their R&D planning. PATTERN determines those current technologies that are deficient and need to be improved to contribute to national defense and science.

PATTERN (also known as Relevance Analysis) can, using the averaged opinion of experts in conjunction with a relevance network, derive rankings of occupational safety and health hazards and abatement projects, and establish their priorities. The relevance network creates a structure for occupational groupings, occupational hazards, and abatement projects. Experts evaluate nodes of the network for their relevance to connected nodes at the next highest level of the network. The evaluations of the experts are averaged at each node. To create the relevance network, an overall objective is defined. A relevance network

is constructed in which each level of the network describes the total need for increased capability to meet the overall objective. Lower network levels describe total need in increasing detail. Each network node represents a specific need for increased capability. The branches which connect two nodes that are exactly one level away from each other, provide logical connections between the levels of the network. Lower level nodes on a branch are subdivisions of the node on the higher level.

9. <u>The Project Rating Value System</u>

This method is currently used by the Naval Facilities Engineering Command to evaluate and set priorities for proposed military construction projects. Five factors common to all military construction projects are evaluated, weighted, and summed for each proposed project to obtain the project rating value. A larger project rating value corresponds to a higher priority for funding. The five factors are:

- F_1 Mission of the installation where the project is to be located
- F_2 Degree of deficiency that the project will overcome
- F_3 Type of facility, determined by DoD basic category codes for military real property
- F_4 Economic aspects of investment
- F_5 Priority assigned the project by the major claimant

F_1 and F_3 are evaluated by referring to matrices that have been derived from claimant-supplied data. F_2, F_4, and F_5 are evaluated by referring to mathematical expressions that have been derived from claimant supplied data. The factor weights for a given project are evaluated by referring to matrices that have been derived from claimant supplied data. The mathematical form of the project rating value (PRV) is $PRV = K\ (w_i F_i)$, where K is simply a scaling variable.

The factors F_2 and F_4 contain none of the occupational health and hazard considerations at present. A major expansion as modification of at least these two factors is likely to be needed to adjust the method to NAVOSH needs.

10. <u>Risk Assessment</u>

This method provides a formula for the evaluation of the severity of a hazard (called a risk score) and a formula for the justification of a recommended abatement measure (called a justification score). The larger the risk score is, the more severe the hazard is. The larger the justification score is, the more justified the abatement is.

$$\text{Risk Score} = \text{Consequences} \times \text{Exposure} \times \text{Probability}$$

$$\text{Justification Score} = \frac{\text{Risk Score}}{\text{Cost Factor} \times \text{Degree of Correction}}$$

The values of all variables may be based on expert judgment. If more precise results are desired, however, each variable may be modeled, with inputs to these variable models derived.

The consequences variable measures "the most probable results" of an accident or illness; the larger the value of consequences is, the more severe the probable results are. The exposure variable measures the "frequency of occurrence of the hazard event" (the hazard event is an event that might initate the sequence of events leading to accident or illness); the larger the value of exposure is, the more frequently the hazard event occurs. The probability variable measures the likelihood that an accident or illness will result if the hazard event occurs; the larger this value is, the greater the likelihood of an accident or illness will be. The cost factor variable measures "estimated dollar cost" of a recommended abatement measure; the greater the estimated cost, the larger the value of the cost factor. The degree of correction variable measures the estimated amount by which the

recommended abatement measure reduces the hazard; the more the abatement measure lessens the hazard, the smaller the value for degree of correction must be.

11. Value Engineering

Value Engineering, as applied to the NAVOSH program, would comprise these steps: (1) define the Navy-wide occupational safety and health problem; (2) assemble the proposed abatement measures; (3) from the problem definition, determine important benefits to be provided by each abatement measure; (4) apply expert judgment to rank benefits numerically in the order of their importance (the higher the benefit rank, the greater the importance); (5) apply expert judgment to rank all abatement measures, once for each benefit (higher abatement measure ranks imply that more benefit is provided by the abatement measure), (6) for each abatement measure compute

$$\text{sum} = \sum_i (\text{rank of benefit } i) \times \left(\begin{array}{l}\text{rank of the abatement measure} \\ \text{in providing benefit } i\end{array}\right)$$

and (7) rank abatement measures in descending order of sums.

In view of the several hundred project requests that the NAVOSH project deals with, this method would require an enormous amount of effort in steps (3), (4), and (5).

II. Assessment of Usefulness for NAVOSH

Of the above methods, the six listed below were judged inappropriate for NAVOSH because excessive amounts of time and resources would be required for their execution:

- Cost-Benefit Fault Tree Analysis
- Cost-Benefit Type Methods
- Goal Programming

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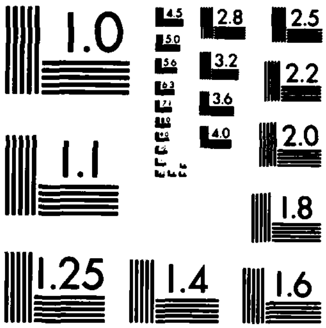

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

- Modeling
- PATTERN
- Project Rating Value System

The remaining five methods were again screened to determine how each would incorporate cost effectiveness criteria and yet be simple to implement.

During this third screening it became obvious that the complex cost-effectiveness factors of NAVOSH projects could not be handled adequately by any of the remaining NAVOSH prioritization methods as currently structured. However, it was observed that some of these methods featured techniques for aggregating data that might be used in the NAVOSH prioritization method.

Our primary interest at this point was in finding the most appropriate way of summing or integrating project information as dissimilar as NAVOSH evaluation data into a rating or expression of relative value meaningful to NAVOSH decision makers. Some of the integrating techniques employed in the five remaining methods appeared to be possible choices.

The DoD risk assessment code method employs a matrix to combine the hazard severity factor and the mishap probability factor. In general, this method gives an index, I,[a] in the form of a value read from a matrix wherein each row of the matrix is associated with a range of values for x_1 and each column of the matrix is associted with a range of values for x_2.

[a]In these discussions of methods for combining factors, we will denote the prioritization element (also called, interchangeably, an index) by I. The NAVOSH evaluation factors to be combined will be denoted by $x_1, x_2, \ldots, x_n$.

The DoD risk assessement code method also has a feature that "combines" the hazard severity factor (I, II, or III) with the mishap probability factor a, b, c, or d) to yield a composite expression (the risk assessment code, e.g., II.a) consisting of two fields, II and A. The first field contains the hazard severity factor II; the second field contains the mishap probability factor A. More generally, the list technique uses a composite of factors to represent the index, I. Several factors are listed in an order expressing an overall priority. Factors listed at the left outrank all factors to the right regardless of the numbers assigned to the factors.

The most important index is x_1, the next most important is x_2, and so forth. The index would then be symbolized as:

$$I = x_2 \ldots x_n \quad .$$

For example: Three projects are to be prioritized on the basis of three factors. Each factor can have a value of "a" or "b" or "c". The overall rating of the three projects becomes:

Project 1	I_1 = baa
Project 2	I_2 = aaa
Project 3	I_3 = aba.

If these projects are arranged in the priority order resulting from this technique, the order would be Project 2, Project 3, Project 1.

An advantage of this representation for the prioritizable quantity is that all the information present in the x_i factors is retained. By referring to I, NAVOSH projects can be prioritized on the basis of any x_i. Furthermore, unlike most of the other methods discussed, this method does not require the selection of weights for the x_i, nor is its validity affected by small values of the x_i. On the other hand, when n is large, this representation for the index may lead to an expression for I that is cumbersome to some users (e.g., one that has more than five or six digits).

Appendix B

A PROTOTYPE PRIORITIZATION METHOD FOR O&MN MINOR CONSTRUCTION PROJECTS DESIGNED FOR NAVY OCCUPATIONAL SAFETY AND HEALTH (NAVOSH) HAZARD ABATEMENT

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A PROTOTYPE PRIORITIZATION METHOD FOR O&MN MINOR CONSTRUCTION PROJECTS DESIGNED FOR NAVY OCCUPATIONAL SAFETY AND HEALTH (NAVOSH) HAZARD ABATEMENT

I. Introduction

This appendix describes the prototype NAVOSH prioritization method resulting from SRI's research under the Phase I ONR contract. The method was subjected to a brief field test by SRI at selected Navy installations.

The method uses a highly flexible system of screening as a means of determining relative values of projects. The principles underlying the screening are adapted from the Risk Assessment Code matrix prescribed by DoD. The values assigned in the matrices are SRI value judgments.

Section II gives a description of the procedures needed to implement the method. Definitions of terms used are given in Section III. Section IV provides four exhibits: the structure of the method and the integrative flow of data through the structure; the fully developed screens (matrices) into which the data are entered; the worksheet of the prioritization data submitted for computer processing in the Navy Environmental Support Office (NESO) Occupational Safety and Health Report (OCR) reporting system; and a standardized table of days lost per injury.

II. Description of Procedure

1. General Concept

The prioritization procedure described herein is based on the assumption that knowledgable personnel at the activity initiating a project are best qualified to provide the data relating to that project and its local context. In addition, this procedure acknowledges that personnel at progressively higher echelons in the project review chain are best qualified to judge the desirability of a particular project in relation to projects proposed by other activities, and to judge the impacts that each project may have on the operations of the Navy-wide shore establishment and, ultimately, on fleet readiness. Accordingly, the procedure begins at the activity level, where certain facts are generated in a standardized form. Subsequently, these facts are reviewed, as appropriate, by the cognizant NAVFAC Engineering Field Division (EFD), by the originating activity's Major Claimant, or Sub Major Claima-:, and last by OPNAV or a delegated authority such as NAVFAS, whei. the final project priority and funding decisions are made.

As shown in Exhibit A in Section IV, the evaluation of a proposed project includes a consideration of (1) the risk to personnel that can be attributed to a known occupational hazard situation; (2) the corrective action that is proposed for abating the cited hazard; and (3) the facility requirements that may influence the project approval decision. In Exhibit A, each of these "Major Factors" in hazard control assessment is based on a number of subordinate "Decision Parameters," and these, in turn are supported by elements of "Basic Data." The manner in which these basic data elements are to be expressed is shown in the column entitled "How to Express." The four columns on the right side of Exhibit A display "Xs" to denote the echelon in the review/approval chain that is responsible for generating (or reviewing substantively) each data element shown. The process begins at the "activity" column and moves to the right through engineering review

(e.g., by the EFD), review by the Major Claimant or Sub Major Claimant (including the selection of intermediate "indexes" to represent the aggregated implications of the basic data submitted by the activity), and final approval or disapproval by the OPNAV/NAVFAC designee.

This procedure is designed to supplant the Step 1 project initiation procedure used for Special Projects in the past. The results will be recorded in the computerized OCR administered by NESO at CBC, Pt. Hueneme, California.

2. Action by the Local Activity

When a local activity decides to request funding for an abatement project, the Safety Officer of the activity, in coordination with the local Industrial Hygienist, and with advice from the local staff, completes a Basic Data form, Exhibit B, for each project proposed. Under the heading RISK, the respondent circles SAFETY or HEALTH to signify to which of these general areas the project under consideration is most directly related. Only the blanks immediately under the heading chosen need to be completed. Most questions that might arise during completion of the form can probably be answered by reference to "Definitions," Section III. The completed form should be forwarded to the cognizant EFD.

3. Action by the EFD

As indicated in Exhibit A, the EFD reviews all the data on the completed form relating to the cost and technical evaluation of the proposed corrective action. If there is disagreement, the EFD coordinates a mutally agreeable adjustment with the initating activity, and forwards the completed form to the Major Claimant.

4. Action by the Major Claimant

When the completed Basic Data form reaches the Major Claimant, or in some cases the Sub Major Claimant, the process of aggregating the basic data into more manageable "indexes" (as shown in Exhibit A) begins. This process continues later at the OPNAV/NAVFAC level, where the final decision on the proposed project is made. Exhibit C illustrates the final evaluation process, the elements of Basic Data presented in Exhibit B are combined into the Decision Parameters, and then into the Major Factors in Hazard Control Assessment. If disagreements exist about any of the data submitted, the Major Claimant coordinates a mutually agreeable adjustment with the initating activity and the EFD before proceeding with the evaluation. The first page of Exhibit C relates to the assessment of RISK, the second page to the evaluation of the proposed CORRECTIVE ACTION, and the third page to the assessment of FACILITY REQUIREMENTS. The third page also includes the final procedure for combining RISK, CORRECTIVE ACTION, and FACILITY REQUIREMENTS into the overall evaluation of the project.

Referring to the first page of Exhibit C, the Major Claimant begins at upper left to obtain an index for SAFETY MISHAP PROFILE. The input to this matrix, labelled "impact of occurrence," and expressed in "days lost per incident," is obtained from Exhibit D or from an interpolation of the levels of injury in Exhibit D based upon Basic Data item number 5.a, "Severity of the Most Likely Injury." In the matrix labelled HEALTH HAZARD SEVERITY, the "Concentration" is selected on the basis of Basic Data items 8.a (Intensity of Hazard Observed in the Workplace) and 8.b (Concentration of Hazard Permitted by the applicable OSH Standard). The aggregation process continues, following the arrows of Exhibit C, by generating the SAFETY RISK index or the HEALTH RISK index (see Basic Data item 1 of Exhibit A), as appropriate.

In a similar manner, the second page of Exhibit C generates the CORRECTIVE ACTION index (item 13 of Exhibit A), and the third page generates the FACILITY REQUIREMENTS index (item 22). The proposal is then forwarded to OPNAV/NAVFAC.

5. Action by OPNAV/NAVFAC

OPNAV/NAVFAC completes the evaluation of the proposed project by combining the indexes for RISK, CORRECTIVE ACTION, and FACILITY REQUIREMENTS into the final OVERALL EVALUATION index (item 25 of Exhibit A).

The proposed project is then approved or disapproved by OPNAV/NAVFAC on the basis of its relative standing among all proposed projects competing for the available funds.

III Definitions

1. Keyed Definitions

Index (1, 2, etc.)[a]--A dimensionless number derived from a series of observations and used as an indicator or measure of relative importance.

Specific Hazard Name (3.a, 7.a)--A word or words constituting the distinctive designation of the cited hazard; for example, the name of a safety hazard might be "unguarded flywheel" or "lack of fire exit;" the name of a health hazard might be "asbestos fibers in the air," "mercury," or "noise." General terms are not acceptable for health hazards.

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[a] Numbers in parentheses are keyed to Basic Data items on Exhibit A.

For chemical hazards, the specific name of the dangerous chemical is required. As an example, if a solvent is being used, its chemical name e.g., "trichoroethylene" must be given; the word "solvent" is not adequate. If more than one chemical is involved in the work operation, or a chemical mixture is being used, give the chemical name of the single most hazardous chemical involved. If the specific hazard is a chemical by-product or by-product mixture resulting from the work operation, give the chemical name of the single most hazardous by-product.

For noise hazards, specify whether they are steady-state or impulse.

When the cited health standard is one that details ventilation requirements for a particular type of operation, such as spray painting or arc-welding, the specific hazard name should be "insufficient ventilation to control ___." Terms such as spray paint, welding fumes, etc., are adequate only in cases relating to ventilation standards.

Violation (3.b, 7.b)--(a) The designation of the specific health or safety standard that the hazardous condition in the workplace is judged to violate (for example OSHA Standard 29 CFR 1910.1001, covering asbestos hazards).

(b) The workplace condition judged to be a violation.

Probability of Occurence of Injury (safety cases only) (4)--The relative chance that a worker might be injured (in any degree) by exposure to a specific hazard. Might be estimated on the basis of the number of accidents that have occurred in similar situations in the past. The probability of occurrence is based on the likelihood that the hazard will lead to the complete accident sequence and its associated harmful consequences.

Likely (4)--A high chance or probability of occurrence of injury.

Probable (4)--A medium chance or probability of occurrence of injury.

Possible (4)--A low chance of probability of occurrence of injury.

Unlikely (4)--A very low chance or probability of injury.

Occurrence (5)--A mishap, accident, event, or incident that results in injury (in any degree) to a worker.

Impact of Occurrence (5)--The estimated number of workdays expected to be lost as a result of a specific type of injury.

Severity of Most Likely Injury (5.a)--The most likely degree of injury that an average worker could be expected to suffer in a typical accident resulting from the specified hazard; for example, death, loss of one eye, broken arm, skinned knuckles.

Days of Work Lost Per Recorded Incident (5.b)--The estimated number of workdays a worker would miss because of his injury. A schedule of estimated workdays lost for various degrees of injury is provided by NAVFACINST 5100.11C of 3 April 1979 (shown in Exhibit D); for example, amputation of a worker's arm above the elbow results in an estimated 3,150 days of work lost. Estimated days of work lost for degrees of injury not specified in the above schedule may be obtained by extrapolation from that schedule.

Concentration (health cases only) (8a)--The intensity of a health hazard, usually designated by the quantity (in appropriate units) of the hazardous chemical or physical agent present in the work environment.

For chemical exposures, this is usually designated by the airborne concentration of the hazardous substance in the work environment. The concentration for a given substance is usually expressed in the following units: mg/cu m (milligrams per cubic meter of air) for vapors, gases, fumes, or dusts; ppm (parts per million in air volume) for vapors or gases; number of fibers per cubic centimeter of air for asbestos.

For exposures to the energy from physical agents, the following units are usually used: noise--dBA (decibels as determined on an A-weighted scale); X-ray--mR/hr (milliroentgens per hour); microwave--mW/cm^2 (milliwatts per square centimeter of exposed surface area).

The degree of hazard specifically required is an 8-hour time weighted average (TWA) exposure for each worker. To calculate the TWA, various exposure levels affecting an individual worker measured over an 8-hour workday are averaged to produce a single number. Grab samples or peak exposures are not adequate. If the applicable health standard specifies both a TWA permissible exposure limit and a ceiling (an exposure level never to be exceeded), both values are required. In such cases, the standard will be violated even if only one of the two limits is exceeded.

If workers in a single operation are exposed to more than one chemical, the degree of hazard value should be given for the single most hazardous chemical (i.e., the one identified under Specific Hazard Name, item 7.a) should be given.

The objective of these requirements is to describe the hazard under consideration in terms that will allow it to be compared with any recognized health standards for this type of hazard.

Time Between Exposure and Harmful Impacts (health cases only) (9)--The estimated period between the exposure of a worker to a health hazard and the first visible symptoms of an illness resulting from that exposure; expressed as "immediate," "in months," or "in years."

Time spans between exposures and symptoms may or may not be sharply defined. Exposure to some toxic materials may produce immediate effects, which are generally referred to as acute effects. Exposure to other materials, or to the same materials at lower concentrations, will lead to chronic effects in the form of continuing low-grade illnesses or recurrent illnesses. For some toxic materials, such as asbestos, 30 years may elapse between the exposure and the actual onset of occupational disease.

Immediate (9)--Up to 1 month time between exposure and harmful effects

In months (9)--From 1 to 12 months between exposure and harmful effects.

In years (9)--More than 1 year between exposure and harmful effects.

Population impacts (11)--The number of people whose authorized activities on Navy property cause them to be exposed to the specified hazardous condition on a significant number of occasions during a work year; no one should be included in this estimate who is exposed to the cited hazard so infrequently or at such low exposure concentrations that it can be considered insignificant. For example, do not count as exposed those persons who only occasionally pass by the door of a room where a hazard is present.

For specific chemical or physical agents, the population exposed is dependent on the numbers of personnel involved in the

specific activity, the effectiveness of confinement or containment systems, and the process steps involved. For agents requiring extensive processing, potential exposure may be plant-wide, but will vary in intensity. If isolation is practiced, the exposed population may be only one worker per shift. If collection systems are not used to confine potential emissions, personnel not actively engaged in the operation may also be exposed to hazardous substances.

Populations exposed to a specific safety hazard will vary with the type of hazard and its location. If the safety hazard is associated with a specific piece of equipment, only the operator may be exposed. For a grinder, the population exposed could differ according to the safety features of the equipment. If the grinder has a guard, only the operator might be injured through contact with the grinding wheel; on the other hand, if a grinder is without an adequate guard, shattering of the grinding wheel could injure other personnel in the immediate vicinity.

Rate of Exposure (12)--The number of hours per year it is estimated that an average member of the exposed population is exposed to the cited hazardous condition. This figure should be an estimate by someone familiar with the work situation, based on the best available existing information (such as timecards). Special studies to obtain these data are not required. The estimate should be based on net working days per year (i.e., total working days per year minus vacations and holidays, but not sick leave).

For an exposure to a health hazard, the rate of exposure may be easily calculated if the individual works only at the operation in question. However, an employee will generally work in an area of potential exposure for a period of time and move to another location. If the transiency follows a predictable routine, the rate of exposure can be assessed by determining the degree of hazard at all work locations and eliminating those where the potential hazard is minimal.

The rate of exposure to safety risks may also vary. As an example, in general traffic areas, the lack of a guard rail on platforms or hand rails on stair steps may create brief repetitive exposures to several people, including operators, inspectors, and occasional casual personnel. In such cases, calculate average use of the steps or the platforms to determine the rate of exposure.

Installed cost of corrective action (including environmental control technology) (15)--The estimated dollar cost of designing, planning, manufacturing, delivering, constucting, and/or installing the proposed hazard batement system, in current dollars (no inflation). The total cost should also include the cost of any additional provisions that must be made to protect the external environment (e.g., the area surrounding the building in which the hazard exists) from pollution by emissions from the primary hazard abatement system. For example, noxious gases removed from a shop area must not be emitted into surrounding areas if they would create a new hazard to other workers or to the neighborhood.

Change in Annual O&M Cost (caused by corrective action) (16)--The estimated increase or decrease in the annual O&M costs for the facility where the cited hazard exists that would result from installing and operating the proposed hazard abatement system. (These costs are distinct from the inital "installed cost" defined above.) For example, a new shop ventilation system to remove hazardous dust could generate O&M costs for (1) the energy used to drive its electric motors; (2) repair parts; (3) repair labor; (4) production time lost while installing the ventilation system.

Change in Energy Consumption Caused by Correction (17)--The estimated increase or decrease in the annual consumption of energy by the facility where the cited hazard exists that would result from installing and operating the proposed hazard abatement system. The dollar costs of this energy would be addressed under the item called

"change in O&M costs." Here, the emphasis is on change in Btu used per year, to reflect the critical importance of energy to our national economy, quite apart from its current dollar cost.

Time Needed for Construction of the Corrective Action (19)--The estimated period (in months) from date of approval of the proposed abatement system until it is fully operational.

Effectiveness of Corrective Action (20)--The reduction in a Health or Safety risk to be made by the correction action in order to meet a prescribed standard; or, if a standard has not been promulgated for the particular hazard, the reduction of risk accomplished by the corrective action to achieve a judgmentally acceptable level. Thus, the relative measure of effectiveness of the corrective action is a direct function of the degree or magnitude of the hazard before the fix is made. This definition provides an important part of a recommended NAVOSH implementing rule that gives priority to those projects which "correct the most severe hazards the soonest."

Full Compliance, Compliance (20b)--The proposed hazard abatement system can be expected to reduce the cited hazard sufficiently to ensure that the operation will be in complete compliance with the applicable recognized standard.

Effective Life of Correction (21)--The estimated number of years after initial full operation that the proposed hazard abatement system can be expected to control the cited hazard to the level for which the system was designed.

Potential for Relocating the Process or Function to Another Site to Avoid Hazard (23)--The ease with which the process or function could be moved to another site where the cited hazard would not exist, expressed as "high," "medium," or "low." Ease would be judged in terms of the costs of such a move and its potential effect on fleet readiness.

Expected Life of Hazardous Operation (24)--The time period between the date of proposing the hazard abatement system and the estimated date that the hazardous situation might end, for example, because the affected facility is expected to disband, or a new, safer production process is expected to replace the current hazardous one.

2. Hazard Assessment Factor, Decision Parameter, and Supporting Definitions

Hazard--A workplace condition that might result in traumatic injury, health impairment, illness, disease, or death to any worker who is exposed to the condition.

Health Risk--A hazard condition that might cause health impairment, illness, disease, or death (e.g., asbestosis, hearing loss, emphysema, dermatitis). There is typically some time delay between exposure and the appearance of symptoms.

Safety Risk--A hazard condition that might cause physical injury (e.g., cuts, bone breaks, concussion) or death in a worker. Symptoms typically appear immediately after an accident.

Workplace--Any place where Navy employees perform their normal fucntions. Examples include facilities used for the repair and overhaul of vessels, aircraft, or vehicles except for equipment trials; construction; supply services; civil engineering or public works activities; medical services; and office work.

Most Likely Accident or Injury--The type of accident that is most likely to occur to an average worker who is exposed to the cited hazard. For example, the most likely accident expected from climbing a tower ladder not equipped with safety provisions might be a fall from

the ladder. The :impact of occurrence" in this case would be the injury that an average worker could be expected to suffer in a fall from halfway up the ladder, the most representative fall of possible falls.

Mishap Profile (safety cases only)--The combination of the factors describing the specific safety hazard of concern, the probability of injury resulting from that hazard, and the impact of such an injury. This value represents a measure of the inherent harmfulness of the safety hazard.

Hazard Severity (health cases only)--The combination of the factors describing the specific health hazard of concern, the degree of that hazard, and the estimated time between exposure to that hazard and its harmful impacts. This represents a measure of the inherent harmfulness of the health hazard.

Personnel Exposure--The combination of the factors describing the population exposed and their rate of exposure. This value is a measure of the degree to which people are exposed to possible effects of the inherent harmfulness of the hazard.

Cost of Corrective Action--The combination of the factors describing the installed cost of the correction (i.e., the hazard abatement system) and any change in O&M costs occasioned by adoption of the correction. This value is a measure of the economic disadvantages (or possibly advantages) of adopting the proposed correction.

The figure includes costs for design, inspection and supervision, equipment and contingencies, and the escalation factor for inflation.

Technical Evaluation--The combination of the factors describing the time to accomplish the proposed correction, the effectiveness of the correction, the effective life of the correction, and the change in facility energy consumption that would be occasioned by adoption of the proposed correction. This figure is a measure of the technical desirability of the proposed correction.

Risk--The combination of mishap profile (safety cases only), hazard severity (health cases only), and personnel exposure. It is a measure of the relative importance of the hazardous condition under consideration.

Corrective Action--The combination of the cost of the correction and the technical evaluation of the correction. The value is a measure of the relative cost-effectiveness of the proposed correction.

Facility Requirements--The combination of potential for relocating the activity of concern and the expected life of the hazardous operation. It is a measure of the relative need (from an operational viewpoint) to abate the cited hazard.

Overall Evaluation--The combination of the factors describing risk, corrective action, and facility requirements. It is a measure of the overall relative desirability of the proposed hazard abatement project.

3. Terms Used in Matrices of Exhibit C

No Standard--Terms applied when a condition hazardous for workers exists, but no established health or safety standard applies to the situation.

Standard--A rule established by competent authority that designates safe and healthful conditions or practices under which work must be performed to prevent occupational injury or illness.

At Standard--A worker in the workplace is exposed to a hazard level equal to the maximum TWA level permitted under the applicable health standard.

2 x Standard--A worker in the workplace is exposed to a hazard at a level that is more than 2 times the maximum TWA level permitted for that hazard as specified under the applicable health standard.

Ceiling--The hazard level above which no worker may be exposed at any time, as specified by the applicable standard.

Above ceiling--A worker in the workplace may at some time be exposed to a level that lies above the ceiling level for that hazard as specified by the applicable health standard.

Standard (level)--The maximum TWA level to which a worker may be exposed, as specified by the applicable standard.

IV. Exhibits

The four exhibits following show in detail the structure and data flow (Exhibit A); the worksheet of data to be submitted by the requesting activity for each project proposal (Exhibit B); the matrices into which the data are entered (Exhibit C); and the specific days lost per injury (Exhibit D) corresponding to the most likely injury listed in the Mishap Profile (Safety), data items 5a and 5b of Exhibit A.

EXHIBIT A
HAZARD CONTROL ASSESSMENT

MAJOR FACTORS IN HAZARD CONTROL ASSESSMENT	DECISION PARAMETERS	BASIC DATA	HOW TO EXPRESS	ACTIVITY	ENG. REVIEW	MAJOR CLAIMANT	OPNAV / NAVFAC
RISK		1	INDEX: a. SAFETY b. HEALTH				X
(TYPE OF RISK, i.e. HEALTH OR SAFETY)	MISHAP PROFILE (Safety)	2	INDEX			X	
		3 SPECIFIC HAZARD	a NAME	X			
			b VIOLATION	X			
		4 PROBABILITY OF OCCURRENCE OF INJURY	LIKELY/PROBABLE/POSSIBLE/UNLIKELY	X			
		5 IMPACT OF OCCURRENCE	a MOST LIKELY INJURY	X			
			b DAYS WORK LOST PER RECORDED INCIDENT			X	
	HAZARD SEVERITY (Health)	6	INDEX			X	
		7 SPECIFIC HAZARD	a NAME	X			
			b VIOLATION	X			
		8 DEGREE OF HAZARD	a CONCENTRATION, e.g. fibers/cc, ppm, mg/m^3)	X			
			b CONCENTRATION PERMITTED BY STANDARD	X			
		9 TIME BETWEEN EXPOSURE AND HARMFUL IMPACTS	IMMEDIATE/IN MONTHS/IN YEARS			X	
	PERSONNEL EXPOSURE	10	INDEX			X	
		11 POPULATION EXPOSED	NUMBER OF PERSONS	X			
		12 RATE OF EXPOSURE	HOURS/YEAR PER PERSON EXPOSED	X			
CORRECTIVE ACTION		13	INDEX			X	
	COST OF CORRECTIVE ACTION	14	INDEX			X	
		15 INSTALLED COST OF CORRECTION (Including environmental control tech.)	DOLLARS	X			
		16 CHANGE IN ANNUAL O&M COST (Caused by correction)	DOLLARS	X			
		17 CHANGE IN ENERGY CONSUMPTION (Caused by correction)	10^6 Btu/Yr	X			
	TECHNICAL EVALUATION	18	INDEX		X		
		19 TIME TO ACCOMPLISH (Construction)	MONTHS	X			
		20 EFFECTIVENESS OF CORRECTIVE ACTION	a FULL COMPLIANCE Yes/No (Safety)	X			
			b CONCENTRATION, e.g. fibers/cc, ppm (Health)	X			
		21 EFFECTIVE LIFE OF CORRECTION	YEARS	X			
FACILITY REQUIREMENTS		22	INDEX			X	
		23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO ANOTHER SITE TO AVOID HAZARD	HIGH/MEDIUM/LOW			X	
		24 EXPECTED LIFE OF HAZARDOUS OPERATION	YEARS			X	
OVERALL EVALUATION		25	INDEX				X

X Responsible for input of this data item in OCR

→ An item brought forward

}→ Combination of bracketed items produces item indicated

EXHIBIT 8
NAVOSH DATA WORKSHEET

ACTIVITY________________ INITIATED BY:________________
ACTIVITY PROJECT NO.__________ DATE:________________
PROJECT TITLE:________________________________
EFD:______ UIC:______ CLAIMANT:______ SUB CLAIMANT:______

RISK

Check one SAFETY HEALTH

SAFETY	HEALTH
Specific Hazard__________	Specific Hazard__________
Hazard Violation (Regulations)______	Hazard Violation (Regulations)______
Probability (Check one) Likely Probable Possible Unlikely	Concentration of Hazard:______ Units:______
Severity of most likely injury______	Current Standards:______ Units:______
	Time Between Exposure and Harmful Impacts (Check One) Immediate In Months In Years

POPULATION

Normal Working Population Exposed to Hazard (Employees) (Check One)

1-4 Employees 5-9 Employees 10-50 Employees >50 Employees

Rate Of Exposure To Hazard (Hours/Year per Person Exposed) (Check One)

40 40-150 151-959 960-2000 >2000

CORRECTIVE ACTION

Installed Cost of Corrective Action ($\$x10^3$) (Check One)

40	40-60	61-80	81-100	>100

Change in Annual O&M Cost ($\$x10^3$) (Check One)

<(-5)	(-5)-0	1-5	6-10	>10

Change In Energy Consumption Cuased by Corrective Action (10^6 BTu/Year)

(Check One)

<(-500)	(-500)-0	1-500	501-1000	>1000

Time To Accomplish the Construction of Corrective Action (Months) (Check One)

1-3	4-6	7-9	10-12	>12

EFFECTIVENESS OF CORRECTIVE ACTION

Safety--Full Compliance (Check One) Yes No

Health--Concentration: ____________________

Units: ____________________

Effective Life Of Solution (Years) ____________________

FACILITY

Potential for Relocating the Process or Function to Avoid the Hazard (Check One)

HIGH	MEDIUM	LOW

Expected Life of Hazardous Operation (Years) ____________________

OK

EXHIBIT C (Sheet 1 of 3)
HAZARD CONTROL ASSESSMENT FOR RISK

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident) / 4* PROBABILITY OF OCCURRENCE OF INJURY	LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	2	3
2500–4199	1	2	2	3
1200–2499	1	2	3	4
400–1199	1	2	3	4
100–399	1	3	3	4
30–99	2	3	4	5
< 30	2	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed) / 11 POPULATION (PERSONS)	> 50	10–49	5–9	1–4
≥ 2000	1	1	2	2
960–1999	1	1	2	3
160–959	2	2	3	4
40–159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION / 9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS	IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS			
ABOVE CEILING	1	1	1
> 2 x STANDARD	1	1	2
< 2 x STANDARD	1	2	3
NO STANDARD			
SEVERE RISK	1	1	1
MODERATE RISK	1	2	3
LOW RISK	2	3	5

Index 6

See Addendum in the last three pages of this report for revision.

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A

HA-1440-1

EXHIBIT C (Sheet 2 of 3)
HAZARD CONTROL ASSESSMENT (CORRECTIVE ACTION)

COST OF CORRECTIVE ACTION

16: CHANGE IN ANNUAL O&M COSTS ($ x 10³) \ 15: INSTALLED COST OF CORRECTIVE ACTION (Incl. environmental control technology) ($ x 10³)	≤ 40	41-60	61-80	81-100	>100
< (-5)	1	1	2	3	4
(-5)-0	1	2	2	3	4
1-5	2	2	3	4	5
5-10	2	3	3	4	5
>10	2	3	4	5	5

Index 14

TECHNICAL EVALUATION No. 1a (Safety)

20a: EFFECTIVENESS OF CORRECTIVE ACTION		19: TIME TO ACCOMPLISH FIX (MONTHS) 1-3	4-6	7-9	10-12	13-24	> 24
STANDARD EXISTS/LIKELY IMPACT (DAYS LOST)	2500-4200	1	1	1	1	2	2
	1200-2499	1	1	1	2	2	3
	100-1199	2	2	2	3	3	4
	30-99	3	3	3	4	4	5
	< 30	4	4	4	4	5	5
NO STANDARD — PROBABILITY OF OCCURRENCE: LIKELY (DAYS LOST)	1000-4200	1	1	1	1	1	2
	100-999	2	2	2	2	3	3
	< 100	3	3	3	3	4	4
PROBABLE	1000-4200	2	2	2	2	2	3
	100-999	2	2	3	3	3	4
	< 100	3	3	4	4	4	5
POSSIBLE	1000-4200	3	3	3	3	3	4
	100-999	3	3	4	4	4	5
	< 100	4	4	4	5	5	5

Subindex (Safety)

TECHNICAL EVALUATION No. 1b (Health)

20b: EFFECTIVENESS OF CORRECTIVE ACTION	8: CONCENTRATION BEFORE FIX	19: TIME TO ACCOMPLISH FIX (MONTHS) 1-3	4-6	7-9	10-12	13-24	> 24
STANDARD EXISTS	ABOVE CEILING	1	1	1	1	1	2
	> 2 x STANDARD	1	1	1	2	2	3
	< 2 x STANDARD	1	1	2	2	3	3
NO STANDARD	SEVERE RISK	1	1	1	1	1	2
	MODERATE RISK	1	1	1	2	2	3
	LOW RISK	2	2	3	4	4	5

Subindex (Health)

TECHNICAL EVALUATION NO 2

21: EFFECTIVE LIFE OF CORRECTIVE ACTION (Years) \ 17: CHANGE IN ENERGY CONSUMPTION (10^6 Btu)	< (-500)	(-500)-0	1-500	501-1000	> 1000
> 10	1	1	2	2	3
5-9	1	2	2	3	4
3-4	2	2	3	4	4
1-2	2	3	4	4	5
< 1	3	4	4	5	5

Subindex

TECHNICAL EVALUATION =2 \ TECHNICAL EVALUATION =1	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Index 17

TECHNICAL EVALUATION \ COST OF CORRECTIVE ACTION	1	2	3	4	
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Corrective Action Index 13 (See page 3)

See Addendum in the last three pages of this report for revision.

HA-1440-2

EXHIBIT C (Sheet 3 of 3)
HAZARD CONTROL ASSESSMENT

FACILITY REQUIREMENTS

24 / 23		POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD		
		LOW	MEDIUM	HIGH
EXPECTED LIFE OF HAZARDOUS OPERATION (Years)	>10	1	2	4
	6–10	2	3	4
	3–5	2	3	4
	1–2	3	4	5
	< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	FROM PAGE 1 (1a 1b)	FROM PAGE 2 (13)	22
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES			

See Addendum in the last three pages of this report for revision.

HA-1440-3

Exhibit D

Days Lost Per Incident

TYPE OF INJURY	NO. OF LOST WORKDAYS
Fatality	4200
Permanent Disability	4200
Loss of Sight - One Eye	1260
Loss of Sight - Both Eyes	4200
Impairment of Vision-% Impairment X Time Charge For Loss of Sight	
Complete Loss of Hearing, One Ear	420
Complete Loss of Hearing, Both Ears	2100
Impairment of Hearing	% Impairment X Time Charge For Loss of Hearing
Impairment of Extremity	% Impairment X 2,100
Impariment of Body Functions (such as damage to internal organs, loss of speech, damage to lungs, back and etc.)	% Impairment X 4,200
Amputation - Fingers Below Middle Joint	
Thumb	210
Index	140
Middle	105
Ring	84
Little	70
Amputation - Fingers Above Middle Joint	
Thumb	630
Index	420
Middle	350
Ring	315
Little	280

Exhibit D (Continued)

TYPE OF INJURY	NO. OF LOST WORKDAYS
Amptation - Arm, Below Elbow	2520
Amputation - Arm, Above Elbow	3150
Amputation - Great Toe, Below Middle Joint	105
Amputation - Each of Other Toes, Below Middle Joint	53
Amputation - Great Toe, Above Middle Joint	420
Amputation - Each of Other Toes, Above Middle Joint	245
Amputation - Foot At Ankle	1680
Amputation - Leg Below Knee	2100
Amputation - Leg Above Knee	3150
Burns - First Degree	5
Burns - Second Degree	
Less than 10% of Body	20
10-30% of Body	30
30-50% of Body	40
Over 50% of Body	60
Burns - Third Degree	
Less than 10% of Body	40
10-30% of Body	130
30-50% of Body	260
Over 50% of Body	390
Dislocations	
Toe	5
Finger	5
Hip	40
Shoulder	30

Exhibit D (Continued)

TYPE OF INJURY	NO. OF LOST WORKDAYS
Fractures	
Toe	5
Foot	30
Ankle	30
Leg	30
Hip	130
Back	260
Finger	30
Hand	30
Wrist	30
Arm	30
Shoulder	80
Rib	5
Collar Bone	40
Skull	390
Neck	260
Jaw	10
Hernia	30
Lacerations	5
Sprain/Strain	
Ankle	5
Wrist	5
Knee	10
Elbow	5
Shoulder	10
Neck	15
Back	20
Others	Use time charge for any injury not listed above which is estimated to have the same recovery time.

Source: NAVFACINST 5100.11C (03 April 1979)

Appendix C

FIELD TEST DATA SHEETS AND EVALUATION RESULTS

SRI field tested the priority method described in Appendix B by visits to 13 Navy activities or commands. Sufficient data were obtained at 10 of the activities to satisfy the prioritization data needs for 13 of 37 projects examined during the visits. This Appendix consists of an SRI Data Worksheet and the priority evaluation sheets for each of the 13 projects that could be scored by the method.

It should be noted that some of the matrices shown in Appendix B have been revised, reflecting experience gained during the field test, to make them easier to interpret and apply.

INDEX OF SAMPLE PROJECTS

SRI Index	Activity	Project Title	Claimant
22	NAT NAV MED CEN	Air Filtration Protheses Lab	BUMED
24	NAT NAV MED CEN	Air Filtration Dental Lab	BUMED
25	NAT NAV MED CEN	Install Seamless Flooring to Prevent Hg Traps	BUMED
40	NAVORDSTA Indian Head	Provide Noise Reduction Alterations	NAVSEA
	NAVORDSTA Indian Head	Lead Fumes	NAVOSH
50	NRL WDC	Provide Noise Platform	ONR
	NARF JAX	Machine Guarding	NAVAIR
266	NAVREGDENCEN San Diego	Replace Floor Tiles	BUMED
270	NAVOCEANSEACEN San Diego	Install Venti-lation System	CHNAVMAT
	NSC San Diego	Repair Rod Storage Racks	COMNAVSUP
279	NSC Oakland	Correct OSHA Def-iciencies	COMNAVSUP
283	NSC Oakland	Install Ventila-tion system	COMNAVSUP
284	PWC San Diego	Carbon Monoxide Exhaust System	COMNAVFAC

E3-78

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NATNAV MED CEN By: ____

SRI Index No.: 22 Date: ____

Project Title: AIR FILTRATION OF PROSTHETICS LABORATORY

EFD: CHES UIC: ____ Claimant: BUMED

RISK

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: ____ 7.a Specific Hazard: BERYLLIUM IN AIRBORNE DUST

3.b Hazard Violation: ____ 7.b Hazard Violation: 29CFR 1910.252

4. Probability: ____ (likely, probable, possible, unlikely) 8. Degree of Hazard (Concentration): .005 mg/m³ (Units): ____

5.a Type of Injury: ____

9. Time Between Exposure and Harmful Impacts: YEARS (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 6

12. Rate of exposure to hazard: 1040 (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 23,900

16. Change in annual O&M cost: $ + 1,000/ANNUALLY

18. Time to accomplish: 3 (months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance ____ (yes or no) Concentration: .001 mg/m³ (units): ____

20. Effective Life of Solution: 15 (years)

21. Change in Energy Consumption Caused by Fix: 400 (10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW NOT POSSIBLE (High, Medium, Low)

24. Expected Life of Hazardous Operation: 5 (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30 99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS — VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS — VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS — VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS — NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS — NO VIOLATION	< STANDARD	3	4	5
NO STANDARD		1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

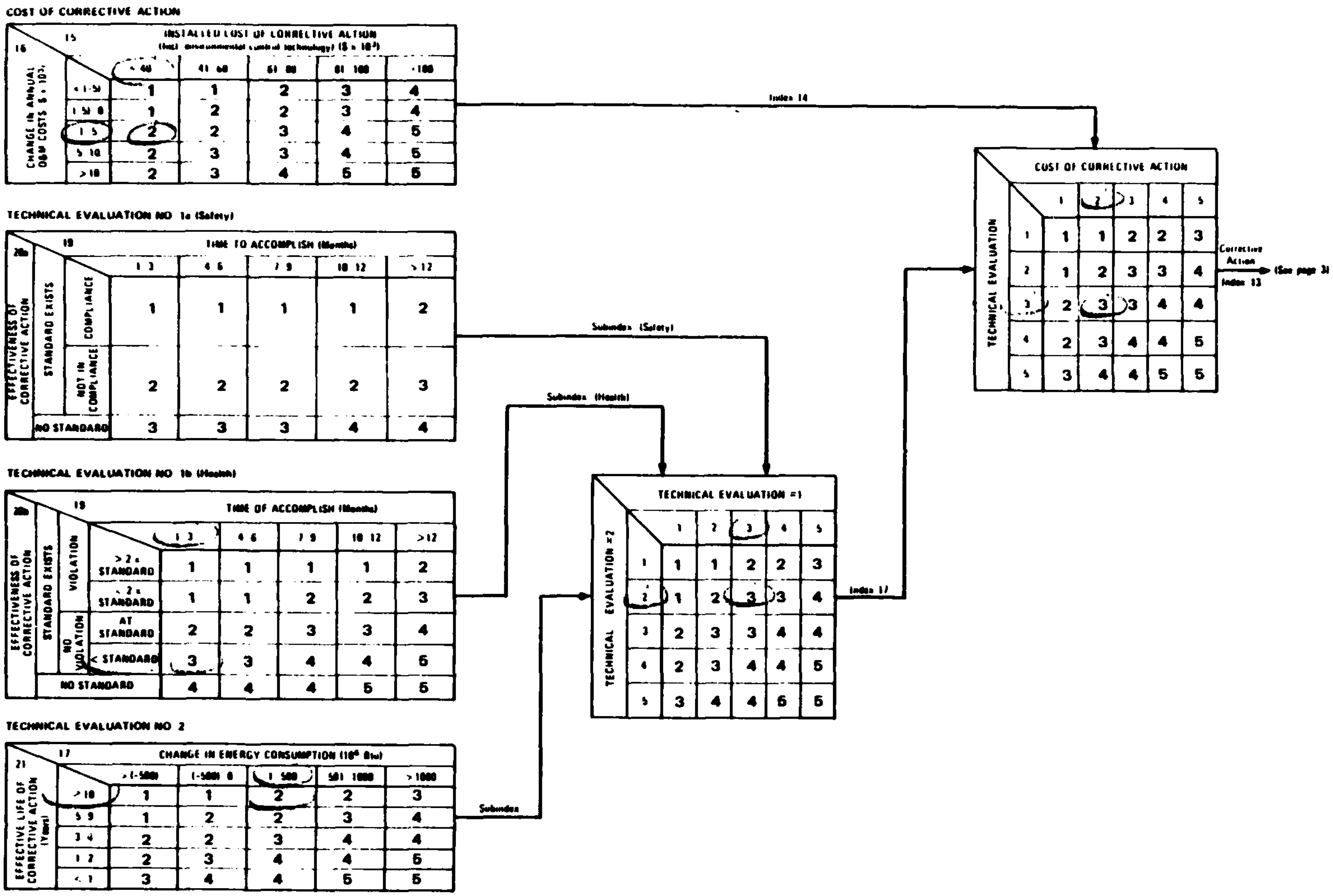
Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
INSTALLED COST OF CORRECTIVE ACTION
CHANGE IN ANNUAL O&M COSTS
TECHNICAL EVALUATION NO 1a (Safety)
TIME TO ACCOMPLISH (Months)
EFFECTIVENESS OF CORRECTIVE ACTION
STANDARD EXISTS
COMPLIANCE
NOT IN COMPLIANCE
NO STANDARD
TECHNICAL EVALUATION NO 1b (Health)
TIME OF ACCOMPLISH (Months)
VIOLATION
NO VIOLATION
> 2 x STANDARD
< 2 x STANDARD
AT STANDARD
< STANDARD
TECHNICAL EVALUATION NO 2
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION (Years)
Index 14
Subindex (Safety)
Subindex (Health)
Subindex
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Index 17
TECHNICAL EVALUATION
Corrective Action
Index 13
(See page 3)

FACILITY REQUIREMENTS

24 EXPECTED LIFE OF HAZARDOUS OPERATION (Years)	23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD: LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

FROM PAGE 1

FROM PAGE 2

	1a 1b	13	22
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	2	3	2

C1-79

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NATNAV MED CEN By:

SRI Index No.: 64 Date:

Project Title: ALTERATIONS TO PROSTHETICS LABORATORY

EFD: CHES UIC: Claimant: BUMED

RISK

circle one:

*1.a SAFETY	1.b HEALTH
3.a Specific Hazard:	7.a Specific Hazard: Be .01 mg/m3
3.b Hazard Violation:	7.b Hazard Violation: 29 CFR-1910.252
4. Probability: (likely, probable, possible, unlikely)	8. Degree of Hazard (Concentration): BY CONTACT
5.a Type of Injury:	(Units):
	9. Time Between Exposure and Harmful Impacts: YEARS (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 8
12. Rate of exposure to hazard: 1040 (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 38,500
16. Change in annual O&M cost: $ 1,000
18. Time to accomplish: 4 (months)

EFFECTIVENESS OF FIX

19.a SAFETY	19.b HEALTH
Full Compliance (yes or no)	Concentration: .001 mg/m3 (units):

20. Effective Life of Solution: 15 (years)
21. Change in Energy Consumption Caused by Fix: 400 (10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW. NOT POSSIBLE (High, Medium, Low)
24. Expected Life of Hazardous Operation: 5 (years)

SAFETY MISHAP PROFILE

IMPACT OF OCCURRENCE (Days lost per incident) [5]	VIOLATION OF STANDARD [4]*	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400 1199	1	2	2	3	4
100-399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

EXPOSURE (Hours/yr per person exposed) [12]	POPULATION (PERSONS) [11]: > 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

CONCENTRATION [8]		[9]	TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS	VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS	VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS	VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS	NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS	NO VIOLATION	< STANDARD	3	4	5
NO STANDARD			1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

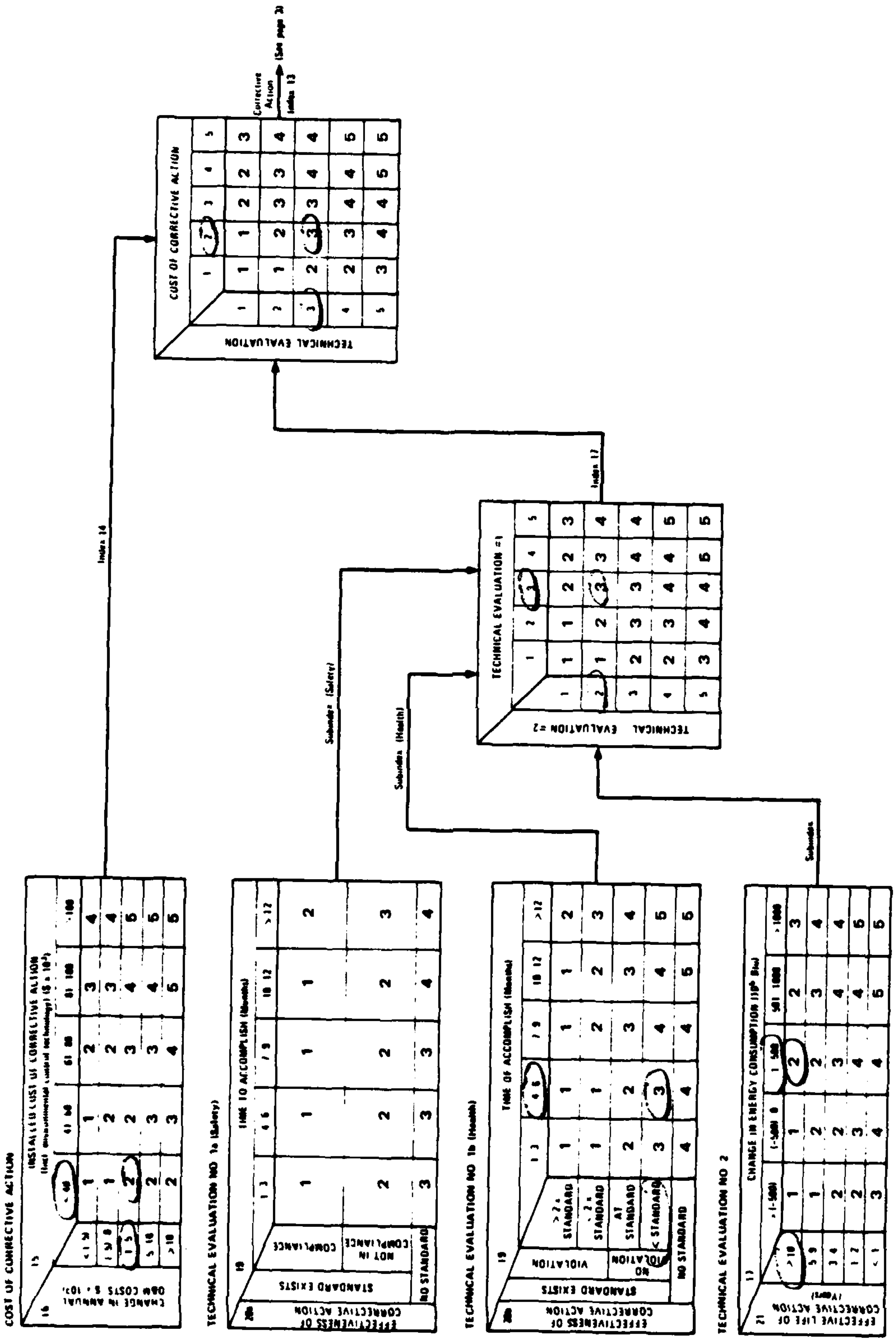
Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION NO 1a (Safety)
TECHNICAL EVALUATION NO 1b (Health)
TECHNICAL EVALUATION NO 2
EFFECTIVENESS OF CORRECTIVE ACTION
STANDARD EXISTS
NO STANDARD
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION

FACILITY REQUIREMENTS

24 EXPECTED LIFE OF HAZARDOUS OPERATION (Years)	23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD: LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	RISK (FROM PAGE 1; 1a 1b)	CORRECTIVE ACTION (FROM PAGE 2; 13)	FACILITY REQUIREMENT (22)
SCORES	2	3	2

C2-79

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NATNAV METJ CEN By: ______

SRI Index No.: 25 Date: ______

Project Title: INSTALL SEAMLESS FLOORING TO PREVENT HG TRAPS

EFD: CHES UIC: ______ Claimant: COMNAVOCEANCOM

RISK

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: ______ 7.a Specific Hazard: Hg

3.b Hazard Violation: ______ 7.b Hazard Violation: 29 CFR 1910.252

4. Probability: ______ (likely, probable, possible, unlikely)

8. Degree of Hazard (Concentration): .02 mg/m³ AIR (Units):

5.a Type of Injury: ______

9. Time Between Exposure and Harmful Impacts: YEARS (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 160

12. Rate of exposure to hazard: 1040 (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 28,600

16. Change in annual O&M cost: $ NO CHANGE

18. Time to accomplish: 4 (months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance ______ (yes or no)

Concentration: .002 mg/m³ (units):

20. Effective Life of Solution: 5 (years)

21. Change in Energy Consumption Caused by Fix: NO CHANGE (10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW, NOT POSSIBLE (High, Medium, Low)

24. Expected Life of Hazardous Operation: 15 (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200–2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30 99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS — VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS — VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS — VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS — NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS — NO VIOLATION	< STANDARD	3	4	5
NO STANDARD		1		

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SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

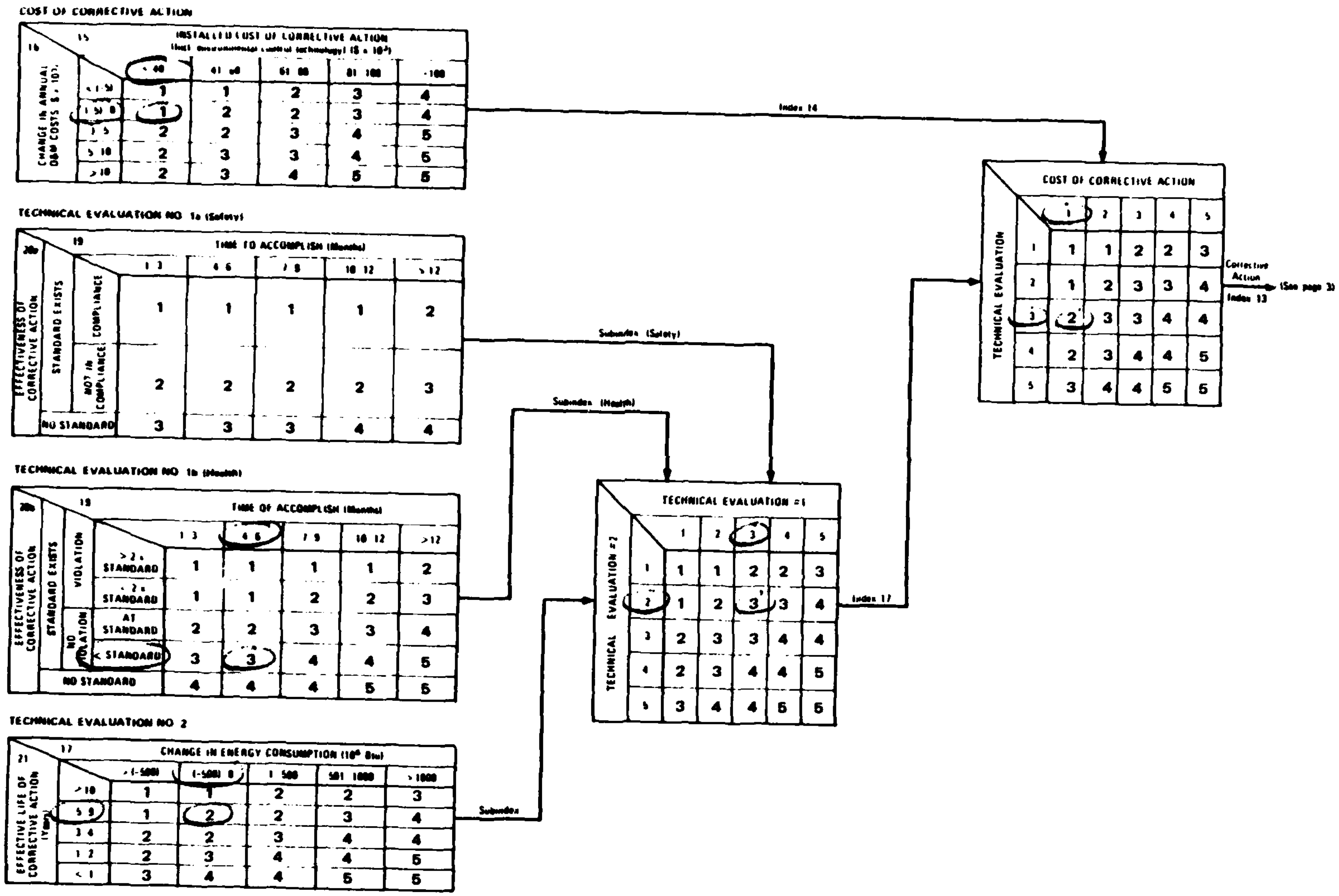
Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
INSTALLED COST OF CORRECTIVE ACTION
CHANGE IN ANNUAL O&M COSTS
TECHNICAL EVALUATION NO. 1a (Safety)
TIME TO ACCOMPLISH (Months)
EFFECTIVENESS OF CORRECTIVE ACTION
STANDARD EXISTS
COMPLIANCE
NOT IN COMPLIANCE
NO STANDARD
TECHNICAL EVALUATION NO. 1b (Health)
TIME OF ACCOMPLISH (Months)
VIOLATION
NO VIOLATION
STANDARD
AT STANDARD
< STANDARD
TECHNICAL EVALUATION NO. 2
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION (Years)
Index 14
Subindex (Safety)
Subindex (Health)
Subindex
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Index 17
COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
Corrective Action
Index 13
(See page 3)

FACILITY REQUIREMENTS

24 EXPECTED LIFE OF HAZARDOUS OPERATION (Years)	23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD		
	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	FROM PAGE 1	FROM PAGE 2	
	1a 1b	13	22
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	1	2	1

CR 4-79

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NAVORD STA By:

SRI Index No.: 40 Date:

Project Title: ALTER NOISE REDUCTION FEATURES IN BLDG. 873

EFD: CHES UIC: Claimant: NAVSEA

RISK

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: 7.a Specific Hazard: NOISE

3.b Hazard Violation: 7.b Hazard Violation: 29CFR-1910.95

4. Probability: (likely, probable, possible, unlikely)

8. Degree of Hazard (Concentration): >90 DB/8 HRS (Units): 91-107 DB

5.a Type of Injury:

9. Time Between Exposure and Harmful Impacts: YEARS (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 30

12. Rate of exposure to hazard: 8 HRS/DAY (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 89,500

16. Change in annual O&M cost: $ 0

18. Time to accomplish: 4-6 (months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance YES (yes or no)

Concentration (units): 85 dBA/8 HRS

20. Effective Life of Solution: 15 (years)

21. Change in Energy Consumption Caused by Fix: NEG (10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW (High, Medium, Low)

24. Expected Life of Hazardous Operation: >10 (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200–2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10–49	5–9	1–4
≥ 2000	1	1	2	2
960–1999	1	1	2	3
160–959	2	2	3	4
40–159	2	3	4	5
< 40	3	4	5	5

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS — VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS — VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS — VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS — NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS — NO VIOLATION	< STANDARD	3	4	5
NO STANDARD		1		

Index 2

Index 10

Index 10

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

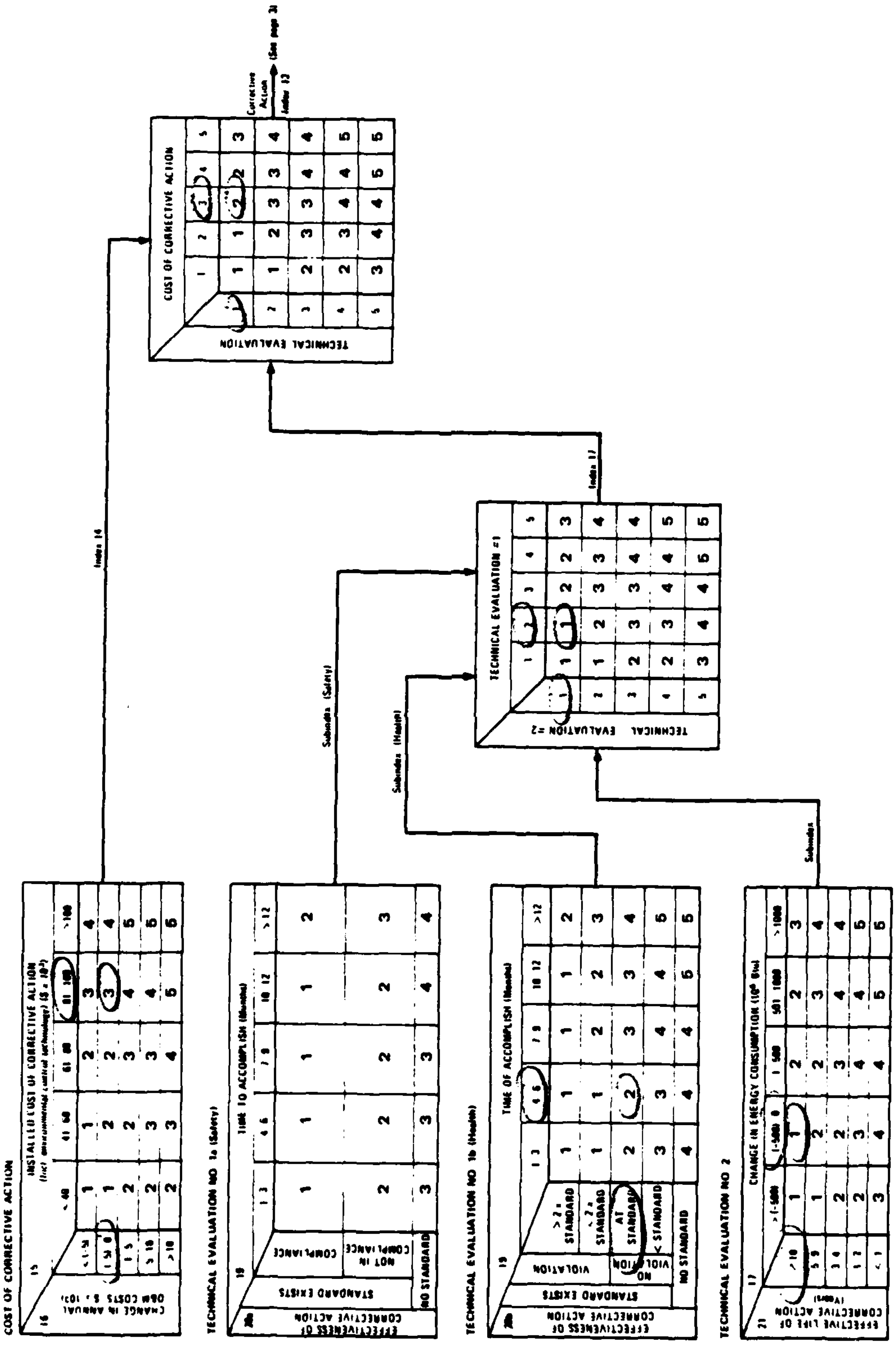
Safety Risk Index 1a → (See page 3)

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk Index 1b → (See page 3)

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
INSTALLED COST OF CORRECTIVE ACTION
CHANGE IN ANNUAL O&M COSTS
TECHNICAL EVALUATION NO 1a (Safety)
TIME TO ACCOMPLISH (Months)
EFFECTIVENESS OF CORRECTIVE ACTION
STANDARD EXISTS
COMPLIANCE
NOT IN COMPLIANCE
NO STANDARD
TECHNICAL EVALUATION NO 1b (Health)
TIME OF ACCOMPLISH (Months)
VIOLATION
NO VIOLATION
TECHNICAL EVALUATION NO 2
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION
Subindex (Safety)
Subindex (Health)
Subindex
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Index 11
Index 14
TECHNICAL EVALUATION
Corrective Action
Index 12

FACILITY REQUIREMENTS

24 EXPECTED LIFE OF HAZARDOUS OPERATION (Years) / 23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

FROM PAGE 1 | FROM PAGE 2

	1a 1b RISK	13 CORRECTIVE ACTION	22 FACILITY REQUIREMENT
SCORES	2	2	1

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NAVORD STA By: ________

SRI Index No.: Not Available Date: ________

Project Title: HEAT MAKE-UP AIR FOR CHEMICAL WEIGHING BLDG. 858

EFD: CHES UIC: ________ Claimant: NAVSEA

RISK (AFTER INSTALLATION OF LOCAL EXHAUST)

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: ________ 7.a Specific Hazard: Pb

3.b Hazard Violation: ________ 7.b Hazard Violation: 1910.1025

4. Probability: ________ (likely, probable, possible, unlikely)

8. Degree of Hazard (Concentration): 0.3 mg/M³ (Units): 1 HOUR SAMPLE

5.a Type of Injury: ________

9. Time Between Exposure and Harmful Impacts: MONTHS (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 6

12. Rate of exposure to hazard: 624 HOURS (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 72,000

16. Change in annual O&M cost: $ +8-10,000

18. Time to accomplish: 1-3 (months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance ________ (yes or no)

Concentration: (units): <.05 mg/M³

20. Effective Life of Solution: 10 (years)

21. Change in Energy Consumption Caused by Fix: 94.6 (10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW (High, Medium, Low)

24. Expected Life of Hazardous Operation: 2-5 (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400 1199	1	2	2	3	4
100-399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION			9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS	VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS	VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS	VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS	NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS	NO VIOLATION	< STANDARD	3	4	5
NO STANDARD			1		

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SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

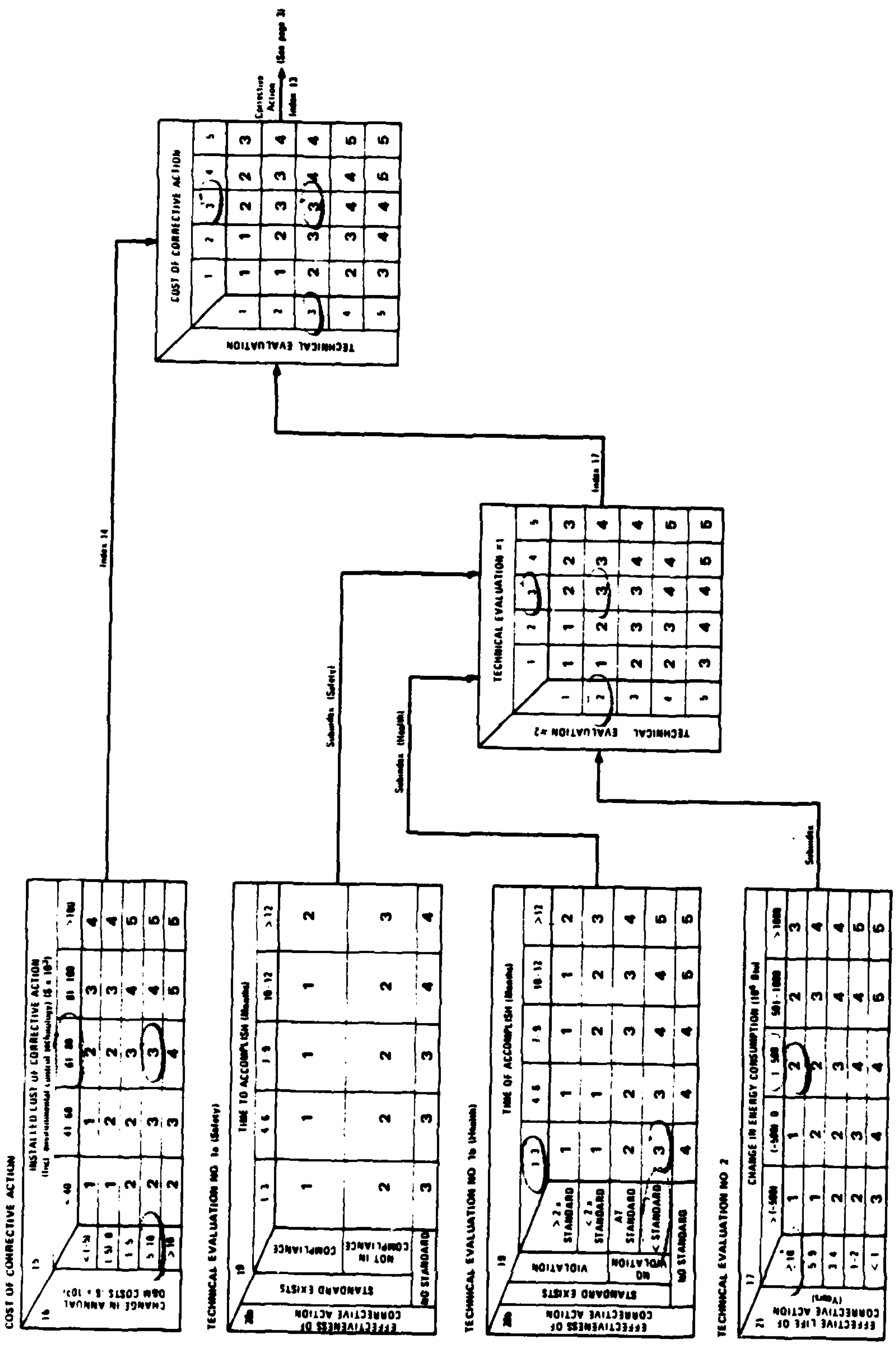
Safety Risk Index 1a → (See page 3)

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk Index 1b → (See page 3)

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
TECHNICAL EVALUATION NO 1a (Safety)
TECHNICAL EVALUATION NO 1b (Health)
TECHNICAL EVALUATION NO 2
STANDARD EXISTS
NO STANDARD
COMPLIANCE
NOT IN COMPLIANCE
VIOLATION
NO VIOLATION

FACILITY REQUIREMENTS

24 — EXPECTED LIFE OF HAZARDOUS OPERATION (Years) / 23 — POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

FROM PAGE 1 — 1a 1b

FROM PAGE 2 — 13

22

	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	3	3	2

R4-79

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NRL WDC By: ____

SRI Index No.: 60 Date: ____

Project Title: PROVIDE SAFETY PLATFORMS, RAILS & WIRE SHIELDS FOR CRANES IN BLDGS 7, 43, 71

EFD: CHES UIC: ____ Claimant: OUR

RISK

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: FALLING, ELECTRO-CUTION

3.b Hazard Violation: 29FR1910.179

4. Probability: LIKELY
(likely, probable, possible, unlikely)

5.a Type of Injury: BROKEN LEG

7.a Specific Hazard: ____

7.b Hazard Violation: ____

8. Degree of Hazard
(Concentration): ____
(Units): ____

9. Time Between Exposure and Harmful Impacts: ____
(Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 10

12. Rate of exposure to hazard: 50 HRS/YR
(hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology--if applicable): $ 90,924

16. Change in annual O&M cost: $ NONE

18. Time to accomplish: 8
(months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance YES
(yes or no)

Concentration: ____
(units): ____

20. Effective Life of Solution: 25
(years)

21. Change in Energy Consumption Caused by Fix: NONE
(10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW
(High, Medium, Low)

24. Expected Life of Hazardous Operation: 25
(years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200–2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30–99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10–49	5–9	1–4
≥ 2000	1	1	2	2
960–1999	1	1	2	3
160–959	2	2	3	4
40–159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS — VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS — VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS — VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS — NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS — NO VIOLATION	< STANDARD	3	4	5
NO STANDARD		1		

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SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

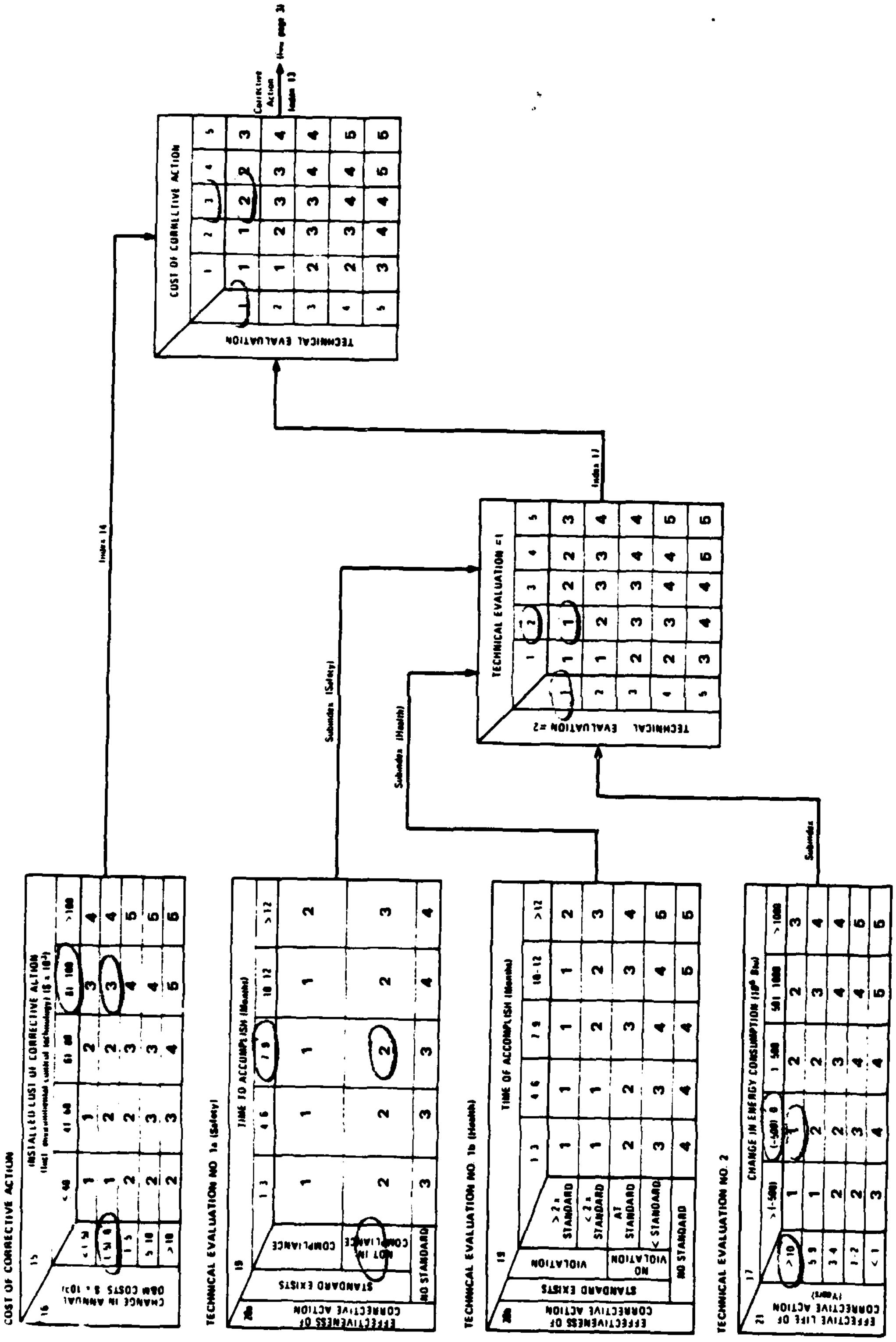
Safety Risk Index 1a → (See page 3)

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk Index 1b → (See page 3)

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A



COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
Corrective Action Index 13
Index 14
Index 17
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Subindex (Safety)
Subindex (Health)
Subindex
INSTALLED COST OF CORRECTIVE ACTION
CHANGE IN ANNUAL O&M COSTS
TECHNICAL EVALUATION NO. 1a (Safety)
TIME TO ACCOMPLISH (Months)
EFFECTIVENESS OF CORRECTIVE ACTION
STANDARD EXISTS
NO STANDARD
COMPLIANCE
NOT IN COMPLIANCE
TECHNICAL EVALUATION NO. 1b (Health)
TIME OF ACCOMPLISH (Months)
VIOLATION
NO VIOLATION
AT STANDARD
< STANDARD
TECHNICAL EVALUATION NO. 2
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION (Years)

FACILITY REQUIREMENTS

24 / 23		POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD		
		LOW	MEDIUM	HIGH
EXPECTED LIFE OF HAZARDOUS OPERATION (Years)	>10	1	2	4
	6–10	2	3	4
	3–5	2	3	4
	1–2	3	4	5
	< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	RISK (FROM PAGE 1; 1a 1b)	CORRECTIVE ACTION (FROM PAGE 2; 13)	FACILITY REQUIREMENT (22)
SCORES	3	2	1

E1-80

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NARF NAS JAX   By: ____

SRI Index No.: ____   Date: 9/20/79

Project Title: MACHINE GUARDING

EFD: SOUTHDIV   UIC: 65886   Claimant: NAVAIR

RISK

circle one:

*1.a SAFETY   1.b HEALTH

3.a Specific Hazard: MACHINE GUARD

3.b Hazard Violation: 29 CFR 1910.219

4. Probability: PROBABLE
(likely, probable, possible, unlikely)

5.a Type of Injury: AMPUTATION OF FINGER

7.a Specific Hazard: ____

7.b Hazard Violation: ____

8. Degree of Hazard (Concentration): ____
(Units): ____

9. Time Between Exposure and Harmful Impacts: ____
(Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 450

12. Rate of exposure to hazard: 1040
(hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 13,627

16. Change in annual O&M cost: $ 0

18. Time to accomplish: 12
(months)

EFFECTIVENESS OF FIX

19.a SAFETY   19.b HEALTH

Full Compliance YES
(yes or no)

Concentration: ____
(units): ____

20. Effective Life of Solution: 5
(years)

21. Change in Energy Consumption Caused by Fix: 0
(10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW
(High, Medium, Low)

24. Expected Life of Hazardous Operation: 5
(years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500-4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400-1199	1	2	2	3	4
100-399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION			9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS	VIOLATION	ABOVE CEILING	1	1	1
		> 2 x STANDARD	1	1	2
		< 2 x STANDARD	1	2	3
	NO VIOLATION	AT STANDARD	2	3	4
		< STANDARD	3	4	5
NO STANDARD			1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

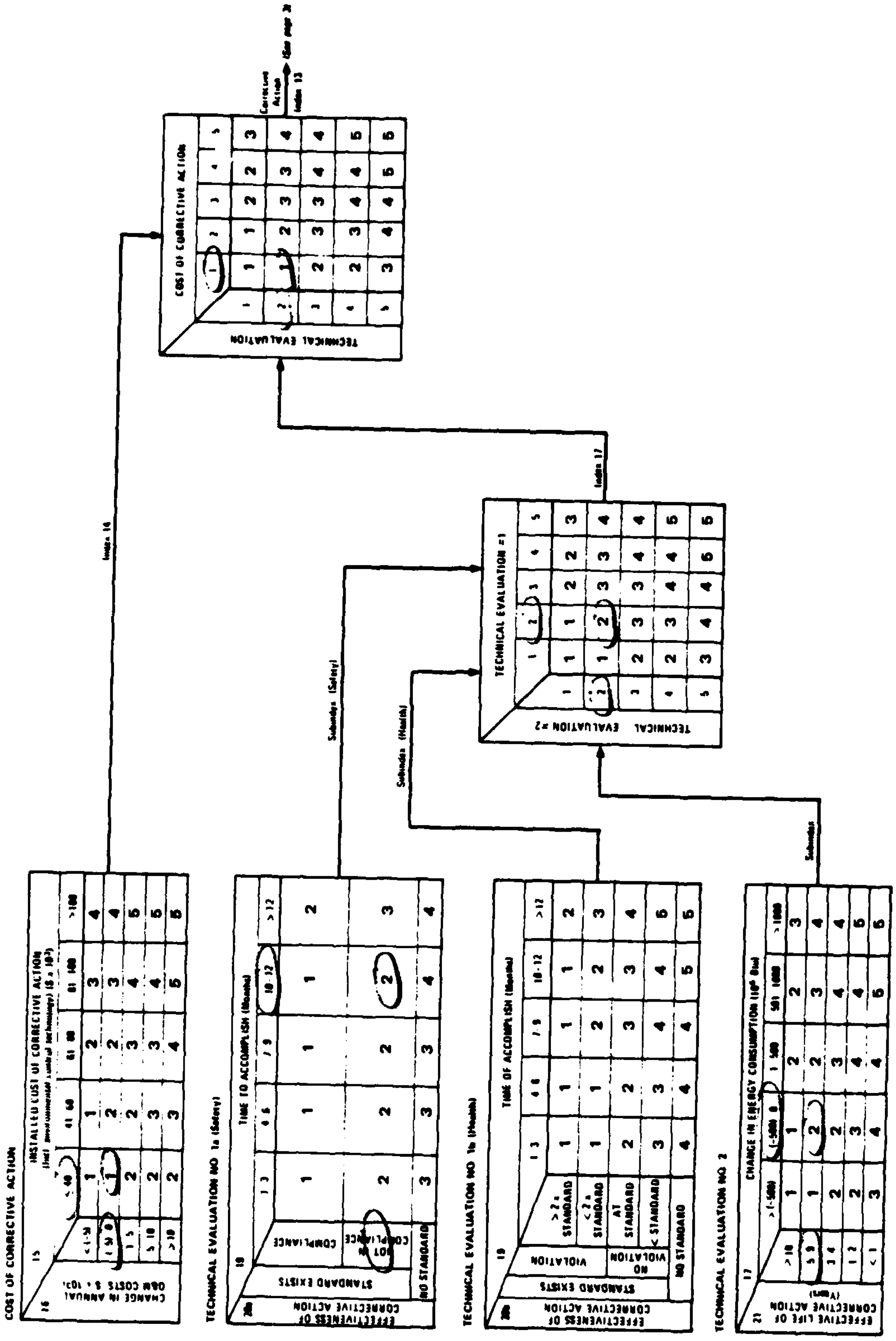
Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION NO 1a (Safety)
TECHNICAL EVALUATION NO 1b (Health)
TECHNICAL EVALUATION NO 2
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
TECHNICAL EVALUATION
COST OF CORRECTIVE ACTION

FACILITY REQUIREMENTS

24 \ 23		POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD		
EXPECTED LIFE OF HAZARDOUS OPERATION (Years)		LOW	MEDIUM	HIGH
	>10	1	2	4
	6–10	2	3	4
	3–5	2	3	4
	1–2	3	4	5
	< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

FROM PAGE 1

FROM PAGE 2

	1a 1b	13	22
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	2	1	2

Data items of Exhibit A)

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NAVREGCENCEN - San Diego, CA. By: Freeman / C [illegible]

~~SRI Index~~ No.: 61-79 / #266 Date: 19 September 1979

Project Title: Replace floor Tiles and Coverings with Seamless Material

EFD: WESTDIV UIC: Claimant: BUMED

RISK

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: 7.a Specific Hazard: Inhalation of mercury vapor

3.b Hazard Violation: 7.b Hazard Violation: OSHA 1910.1000

4. Probability: (likely, probable, possible, unlikely)

8. Degree of Hazard (Concentration): 0.02

5.a Type of Injury: (Units): mg/M³

9. Time Between Exposure and Harmful Impacts: Years (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 350

12. Rate of exposure to hazard: 2050 (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 47,100

16. Change in annual O&M cost: $ none to slight reduction

18. Time to accomplish: 2 (months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance (yes or no) Concentration: 0.005 (units): mg/M³

20. Effective Life of Solution: 10 (years)

21. Change in Energy Consumption Caused by Fix: None to very slight reduction (10^3 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: Low (High, Medium, Low)

24. Expected Life of Hazardous Operation: 20+ (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10-49	5-9	1-4
> 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION			9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS	VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS	VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS	VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS	NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS	NO VIOLATION	< STANDARD	3	4	5
NO STANDARD			1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

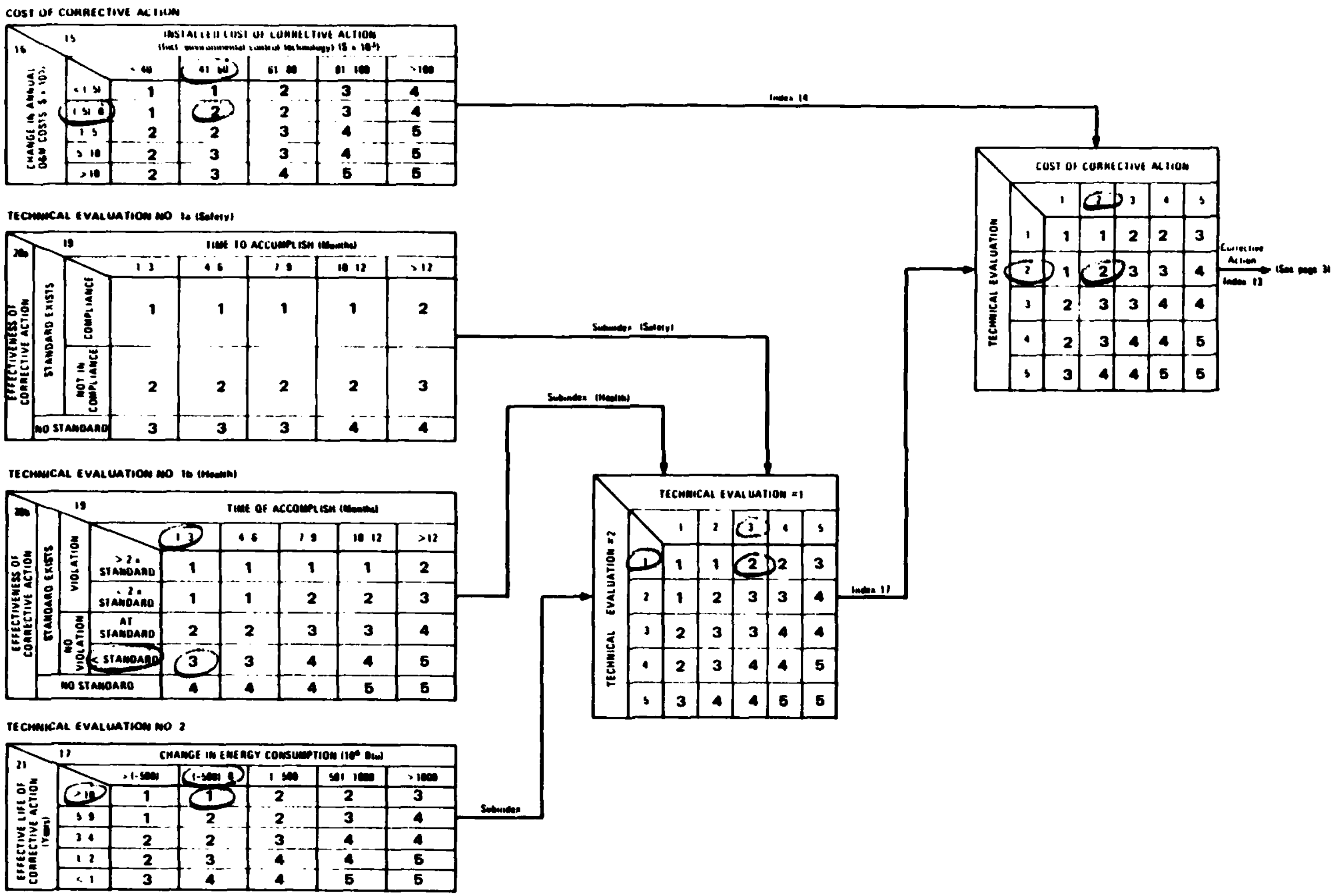
Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
INSTALLED COST OF CORRECTIVE ACTION
CHANGE IN ANNUAL O&M COSTS
TECHNICAL EVALUATION NO 1a (Safety)
TIME TO ACCOMPLISH (Months)
EFFECTIVENESS OF CORRECTIVE ACTION
STANDARD EXISTS
COMPLIANCE
NOT IN COMPLIANCE
NO STANDARD
TECHNICAL EVALUATION NO 1b (Health)
TIME OF ACCOMPLISH (Months)
VIOLATION
NO VIOLATION
> 2 x STANDARD
< 2 x STANDARD
AT STANDARD
< STANDARD
TECHNICAL EVALUATION NO 2
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION (Years)
Index 14
Subindex (Safety)
Subindex (Health)
Subindex
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Index 17
TECHNICAL EVALUATION
Corrective Action
Index 13
(See page 3)

FACILITY REQUIREMENTS

24 EXPECTED LIFE OF HAZARDOUS OPERATION (Years) \ 23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements
Index 22

OVERALL EVALUATION

FROM PAGE 1

FROM PAGE 2

	1a 1b RISK	13 CORRECTIVE ACTION	22 FACILITY REQUIREMENT
SCORES	3	2	1

Enclosure 5

(Data items of Exhibit A)

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NAVOCEANSYSCEN, San Diego, CA By: Freeman, Staley

~~SRI Index~~ No.: EI-77 / #270 Date: 19 September 1979

Project Title: Install Ventilation System in Foundry, Building 188.

EFD: WESTDIV UIC: ______ Claimant: CNM

RISK

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: ______

3.b Hazard Violation: ______

4. Probability: ______
(likely, probable, possible, unlikely)

5.a Type of Injury: ______

7.a Specific Hazard: Silica dust

7.b Hazard Violation: 1910.1000 (c)

8. Degree of Hazard (Concentration): varies between 12-45
(Units): mg/m³

9. Time Between Exposure and Harmful Impacts: YEARS
(Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 3

12. Rate of exposure to hazard: (2 hrs day) (6 days/week) (48 weeks/year) = 576
(hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 89,000

16. Change in annual O&M cost: $ 3,000

18. Time to accomplish: 6
(months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance ______
(yes or no)

Concentration: full compliance
(units):

20. Effective Life of Solution: 10
(years)

21. Change in Energy Consumption Caused by Fix: 200
(10⁶ Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: Low
(High, Medium, Low)

24. Expected Life of Hazardous Operation: 10
(years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500-4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400-1199	1	2	2	3	4
100-399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10–49	5–9	1–4
≥ 2000	1	1	2	2
960–1999	1	1	2	3
160–959	2	2	3	4
40–159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS — VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS — VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS — VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS — NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS — NO VIOLATION	< STANDARD	3	4	5
NO STANDARD		1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

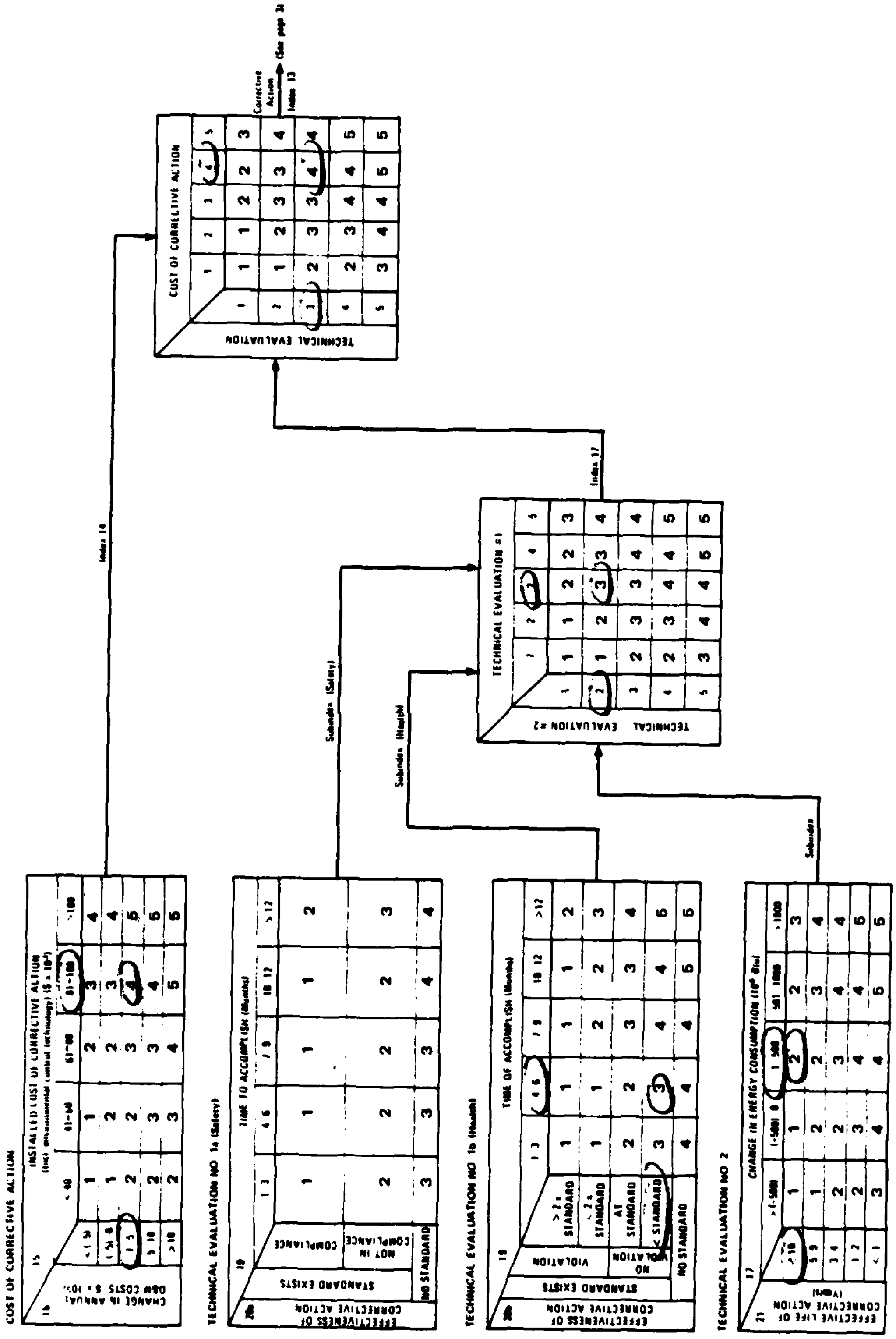
Safety Risk Index 1a → (See page 3)

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
[illegible]	2	3	4	4	5
5	3	4	4	5	5

Health Risk Index 1b → (See page 3)

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A



COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
Index 14
Index 17
Subindex (Safety)
Subindex (Health)
Subindex
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
TECHNICAL EVALUATION NO 1a (Safety)
TECHNICAL EVALUATION NO 1b (Health)
TECHNICAL EVALUATION NO 2
STANDARD EXISTS
NO STANDARD
VIOLATION
COMPLIANCE
NOT IN COMPLIANCE

FACILITY REQUIREMENTS

24 \ 23		POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD		
EXPECTED LIFE OF HAZARDOUS OPERATION (Years)		LOW	MEDIUM	HIGH
	>10	1	2	4
	6–10	2	3	4
	3–5	2	3	4
	1–2	3	4	5
	< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	FROM PAGE 1	FROM PAGE 2	
	1a 1b	13	22
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	3	4	2

Enclosure 5

Data items of Exhibit A)

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NSC San Diego   By: Freeman Cisky

~~SRI Index No.:~~ Not available   Date: 20 Sept. 79

Project Title: Safety Bars for Metal Storage Racks

EFD: WESTDIV   UIC: ____   Claimant: NAVSUP

RISK

circle one:

*1.a SAFETY   1.b HEALTH

3.a Specific Hazard: falling materials   7.a Specific Hazard: ____

3.b Hazard Violation: 1910.1000   7.b Hazard Violation: ____

4. Probability: POSSIBLE (likely, probable, possible, unlikely)   8. Degree of Hazard (Concentration): ____ (Units): ____

5.a Type of Injury: Fractured skull

9. Time Between Exposure and Harmful Impacts: ____ (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 6

12. Rate of exposure to hazard: 1040 (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 56,000

16. Change in annual O&M cost: $ none

18. Time to accomplish: 2 (months)

EFFECTIVENESS OF FIX

19.a SAFETY   19.b HEALTH

Full Compliance YES (yes or no)   Concentration: ____ (units): ____

20. Effective Life of Solution: 20 (years)

21. Change in Energy Consumption Caused by Fix: none (10^3 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: HIGH (High, Medium, Low)

24. Expected Life of Hazardous Operation: 20 (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS — VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS — VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS — VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS — NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS — NO VIOLATION	< STANDARD	3	4	5
NO STANDARD		1		

Index 2

Index 10

Index 10

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

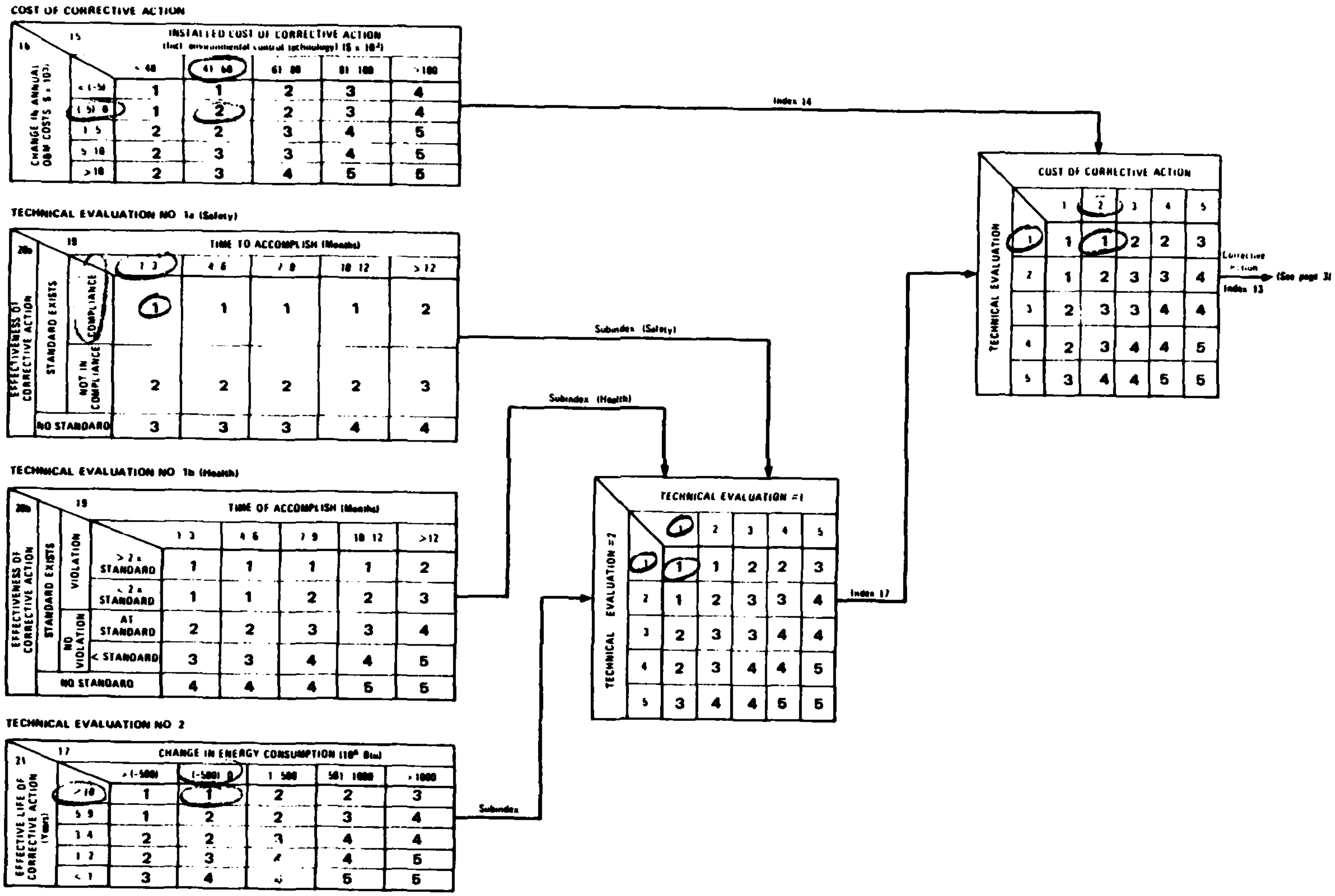
Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A



COST OF CORRECTIVE ACTION

16 CHANGE IN ANNUAL O&M COSTS ($ x 10³) \ 15 INSTALLED COST OF CORRECTIVE ACTION (Incl. environmental control technology) ($ x 10³)	< 40	41-60	61-80	81-100	> 100
< (-5)	1	1	2	3	4
(-5)-0	1	2	2	3	4
1-5	2	2	3	4	5
5-10	2	3	3	4	5
> 10	2	3	4	5	5

TECHNICAL EVALUATION NO 1a (Safety)

20a EFFECTIVENESS OF CORRECTIVE ACTION \ 18 TIME TO ACCOMPLISH (Months)	1-3	4-6	7-9	10-12	> 12
STANDARD EXISTS – COMPLIANCE	1	1	1	1	2
STANDARD EXISTS – NOT IN COMPLIANCE	2	2	2	2	3
NO STANDARD	3	3	3	4	4

TECHNICAL EVALUATION NO 1b (Health)

20b EFFECTIVENESS OF CORRECTIVE ACTION \ 19 TIME OF ACCOMPLISH (Months)	1-3	4-6	7-9	10-12	> 12
STANDARD EXISTS – VIOLATION – > 2 x STANDARD	1	1	1	1	2
STANDARD EXISTS – VIOLATION – < 2 x STANDARD	1	1	2	2	3
STANDARD EXISTS – NO VIOLATION – AT STANDARD	2	2	3	3	4
STANDARD EXISTS – NO VIOLATION – < STANDARD	3	3	4	4	5
NO STANDARD	4	4	4	5	5

TECHNICAL EVALUATION NO 2

21 EFFECTIVE LIFE OF CORRECTIVE ACTION (Years) \ 17 CHANGE IN ENERGY CONSUMPTION (10^6 Btu)	> (-500)	(-500)-0	1-500	501-1000	> 1000
> 10	1	1	2	2	3
5-9	1	2	2	3	4
3-4	2	2	[illegible]	4	4
1-2	2	3	[illegible]	4	5
< 1	3	4	[illegible]	5	5

TECHNICAL EVALUATION #1

TECHNICAL EVALUATION #2 \ TECHNICAL EVALUATION #1	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

COST OF CORRECTIVE ACTION

TECHNICAL EVALUATION \ COST OF CORRECTIVE ACTION	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

FACILITY REQUIREMENTS

EXPECTED LIFE OF HAZARDOUS OPERATION (Years) (24) \ POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD (23)	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	FROM PAGE 1 (1a 1b)	FROM PAGE 2 (13)	(22)
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	3	1	4

Enclosure 3 (Data items of Exhibit A)

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NSC - Oakland, CA   By: Freeman / Gilley

~~SRI Index~~ No.: R2-78 / #279   Date: 14 Sept. 79

Project Title: Install Guards for Overhead Conveyor Systems and Correct Misc. OSHA Deficiencies in Buildings 312, 313, 413 and 421

EFD: WESTDIV   UIC: ______   Claimant: NAVSUP

RISK

circle one:

*1.a SAFETY	1.b HEALTH
3.a Specific Hazard: falling material	7.a Specific Hazard: ______
3.b Hazard Violation: 1910.212 and 1910.309	7.b Hazard Violation: ______
4. Probability: Possible (likely, probable, possible, unlikely)	8. Degree of Hazard (Concentration): ______ (Units): ______
5.a Type of Injury: skull fracture	9. Time Between Exposure and Harmful Impacts: ______ (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: ~ 100
12. Rate of exposure to hazard: 2080 (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 216,000
16. Change in annual O&M cost: $ none
18. Time to accomplish: 12 (months)

EFFECTIVENESS OF FIX

19.a SAFETY	19.b HEALTH
Full Compliance YES (yes or no)	Concentration: ______ (units): ______

20. Effective Life of Solution: 20 (years)
21. Change in Energy Consumption Caused by Fix: None (10^3 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: Low (High, Medium, Low)
24. Expected Life of Hazardous Operation: 20 (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident) / 4* VIOLATION OF STANDARD	VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30 99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed) / 11 POPULATION (PERSONS)	> 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS	IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS	VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS	VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS	VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS	NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS	NO VIOLATION	< STANDARD	3	4	5
NO STANDARD			1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

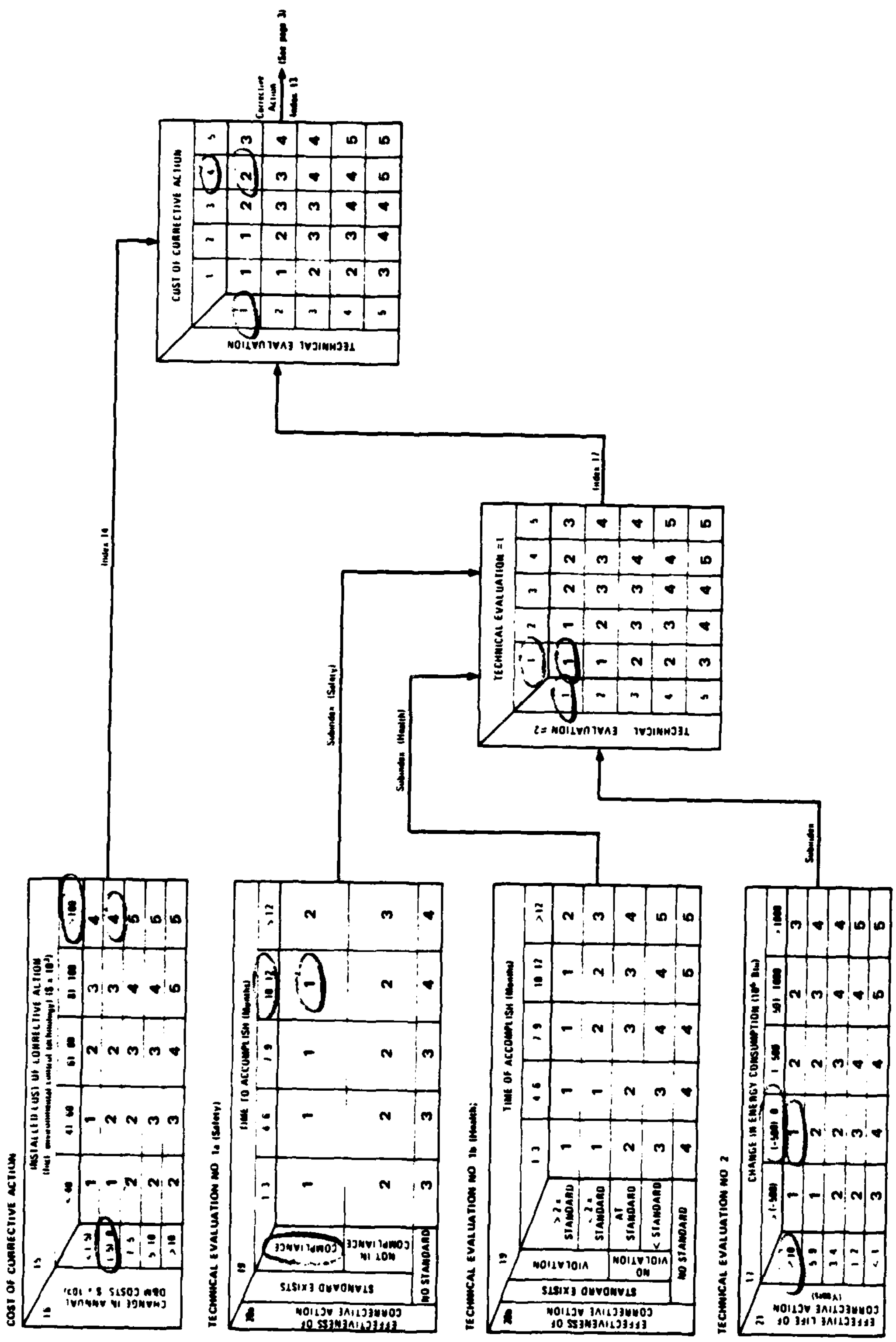
Safety Risk → (See page 3)
Index 1a

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk → (See page 3)
Index 1b

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
Corrective Action Index 13
(See page 3)
Index 14
Index 12
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Subindex (Safety)
Subindex (Health)
Subindex
CHANGE IN ANNUAL O&M COSTS
TECHNICAL EVALUATION NO 1a (Safety)
TIME TO ACCOMPLISH
STANDARD EXISTS
COMPLIANCE
NOT IN COMPLIANCE
NO STANDARD
EFFECTIVENESS OF CORRECTIVE ACTION
TECHNICAL EVALUATION NO 1b (Health)
TIME OF ACCOMPLISH (Months)
VIOLATION
NO VIOLATION
> 2 x STANDARD
< 2 x STANDARD
AT STANDARD
< STANDARD
TECHNICAL EVALUATION NO 2
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION

FACILITY REQUIREMENTS

EXPECTED LIFE OF HAZARDOUS OPERATION (Years) (24)	POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD (23)		
	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

FROM PAGE 1

FROM PAGE 2

	RISK (1a 1b)	CORRECTIVE ACTION (13)	FACILITY REQUIREMENT (22)
SCORES	2	2	1

Enclosure 3

(Data items of Exhibit A)

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: NSC Oakland, CA. By: Freeman, [illegible]

~~SRI Index~~ No.: 69-77 / #283 Date: 14 Sept. 77

Project Title: Ventilation to Prevent Exposures to Lead

EFD: ______ UIC: ______ Claimant: ______

RISK

circle one:

*1.a SAFETY — 1.b HEALTH

3.a Specific Hazard: ______

3.b Hazard Violation: ______

4. Probability: ______ (likely, probable, possible, unlikely)

5.a Type of Injury: ______

7.a Specific Hazard: Lead fumes

7.b Hazard Violation: 1910.1000

8. Degree of Hazard (Concentration): Peak: 70-73; TWA: 0.04 - 0.05 (Units): mg/m3

9. Time Between Exposure and Harmful Impacts: Years (Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 20

12. Rate of exposure to hazard: 12 (hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology—if applicable): $ 13,175

16. Change in annual O&M cost: $ 2000

18. Time to accomplish: 6 (months)

EFFECTIVENESS OF FIX

19.a SAFETY — 19.b HEALTH

Full Compliance ______ (yes or no)

Concentration: 0.45 Peak (units): ______

20. Effective Life of Solution: 20 (years)

21. Change in Energy Consumption Caused by Fix: 300 (10^6 Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: High (High, Medium, Low)

24. Expected Life of Hazardous Operation: 20 (years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY – NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500 4199	1	1	2	2	3
1200–2499	1	2	2	3	4
400 1199	1	2	2	3	4
100 399	1	2	3	3	4
30 99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10–49	5–9	1–4
≥ 2000	1	1	2	2
960–1999	1	1	2	3
160–959	2	2	3	4
40–159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS – VIOLATION	ABOVE CEILING	1	1	1
STANDARD EXISTS – VIOLATION	> 2 x STANDARD	1	1	2
STANDARD EXISTS – VIOLATION	< 2 x STANDARD	1	2	3
STANDARD EXISTS – NO VIOLATION	AT STANDARD	2	3	4
STANDARD EXISTS – NO VIOLATION	< STANDARD	3	4	5
NO STANDARD		1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

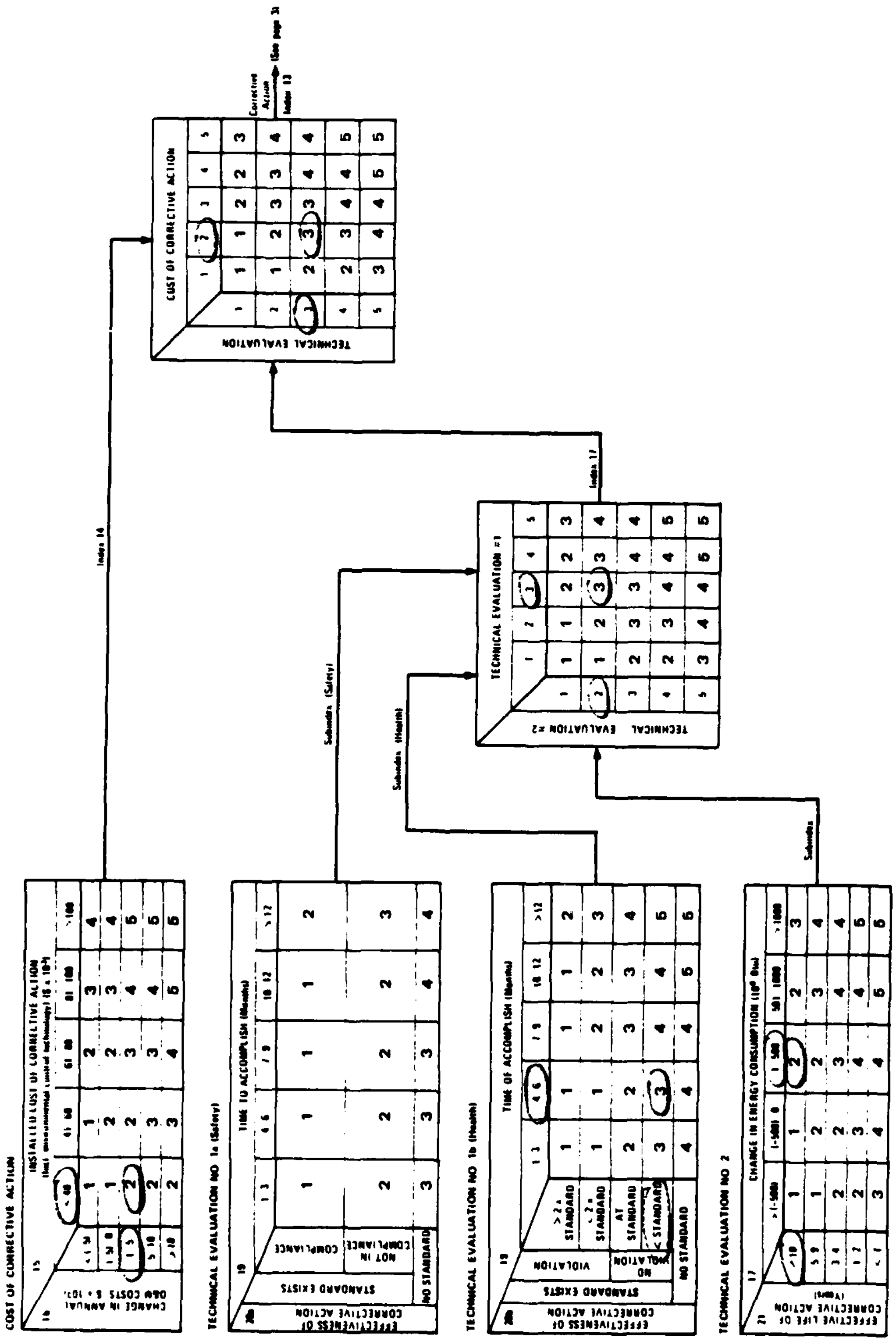
Safety Risk Index 1a → (See page 3)

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk Index 1b → (See page 3)

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A



COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
Corrective Action
Index 13
(See page 3)
Index 14
Index 17
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Subindex (Safety)
Subindex (Health)
Subindex
COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION NO 1a (Safety)
TECHNICAL EVALUATION NO 1b (Health)
TECHNICAL EVALUATION NO 2
TIME TO ACCOMPLISH (Months)
TIME OF ACCOMPLISH (Months)
STANDARD EXISTS
COMPLIANCE
NOT IN COMPLIANCE
NO STANDARD
VIOLATION
NO VIOLATION
EFFECTIVENESS OF CORRECTIVE ACTION
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION
CHANGE IN ANNUAL O&M COSTS

FACILITY REQUIREMENTS

EXPECTED LIFE OF HAZARDOUS OPERATION (Years) 24 \ 23 POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD	LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	FROM PAGE 1	FROM PAGE 2	
	1a 1b	13	22
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	4	3	4

Data items of Exhibit A)

SRI NAVOSH DATA WORKSHEET

PROJECT

Activity: PWC San Diego By: Freeman, [illegible]

~~SRI Index~~ No.: C10-79 / #284 Date: 18 Sept 79

Project Title: Carbon Monoxide Exhaust System -- Building 802

EFD: WESTDIV UIC: ______ Claimant: NAVFAC

RISK

circle one:

*1.a SAFETY 1.b HEALTH

3.a Specific Hazard: ______ 7.a Specific Hazard: carbon monoxide

3.b Hazard Violation: ______ 7.b Hazard Violation: 1910.

4. Probability: ______ (likely, probable, possible, unlikely) 8. Degree of Hazard (Concentration): 50-55

5.a Type of Injury: ______ (Units): mg/m3

9. Time Between Exposure and Harmful Impacts: [illegible]
(Immediate, in months, in years)

POPULATION

11. Population exposed to hazard: 30

12. Rate of exposure to hazard: 2080
(hour/year per person exposed)

FIX

15. Installed cost of fix (including environmental control technology--if applicable): $ 66,000

16. Change in annual O&M cost: $ 6,000

18. Time to accomplish: >12
(months)

EFFECTIVENESS OF FIX

19.a SAFETY 19.b HEALTH

Full Compliance ______ (yes or no) Concentration: 55
(units): mg/m3

20. Effective Life of Solution: 20
(years)

21. Change in Energy Consumption Caused by Fix: 500
(10⁶ Btu/year)

FACILITY

23. Potential for Relocating Activity to Avoid Hazard: LOW
(High, Medium, Low)

24. Expected Life of Hazardous Operation: 20
(years)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident)	4* VIOLATION OF STANDARD	PROBABILITY OF OCCURRENCE OF INJURY — NO STANDARD: LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	1	2	3
2500-4199	1	1	2	2	3
1200-2499	1	2	2	3	4
400-1199	1	2	2	3	4
100-399	1	2	3	3	4
30-99	2	3	3	4	5
< 30	2	3	3	4	5

Index 2

PERSONNEL EXPOSURE

12 EXPOSURE (Hours/yr per person exposed)	11 POPULATION (PERSONS): > 50	10-49	5-9	1-4
≥ 2000	1	1	2	2
960-1999	1	1	2	3
160-959	2	2	3	4
40-159	2	3	4	5
< 40	3	4	5	5

Index 10

Index 10

HEALTH HAZARD SEVERITY

8 CONCENTRATION		9 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS: IMMEDIATE	IN MONTHS	IN YEARS
STANDARD EXISTS — VIOLATION	ABOVE CEILING	1	1	1
	> 2 x STANDARD	1	1	2
	< 2 x STANDARD	1	2	3
STANDARD EXISTS — NO VIOLATION	AT STANDARD	2	3	4
	< STANDARD	3	4	5
NO STANDARD		1		

Index 6

SAFETY MISHAP PROFILE

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

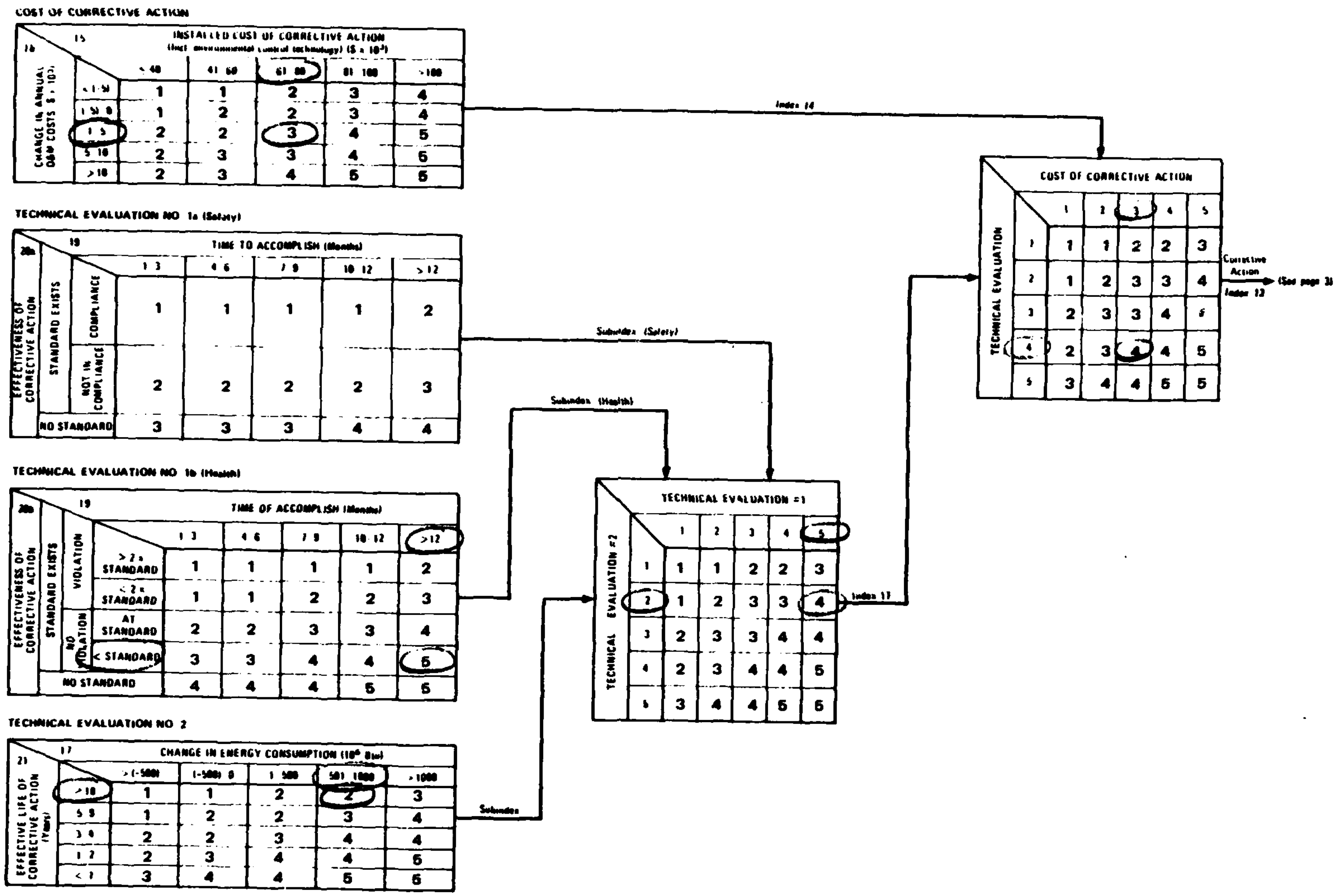
Safety Risk Index 1a → (See page 3)

HEALTH HAZARD SEVERITY

PERSONNEL EXPOSURE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk Index 1b → (See page 3)

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A


COST OF CORRECTIVE ACTION
INSTALLED COST OF CORRECTIVE ACTION
CHANGE IN ANNUAL O&M COSTS
Index 14
TECHNICAL EVALUATION NO. 1a (Safety)
TIME TO ACCOMPLISH (Months)
EFFECTIVENESS OF CORRECTIVE ACTION
STANDARD EXISTS
COMPLIANCE
NOT IN COMPLIANCE
NO STANDARD
Subindex (Safety)
TECHNICAL EVALUATION NO. 1b (Health)
TIME OF ACCOMPLISH (Months)
VIOLATION
NO VIOLATION
> 2 x STANDARD
< 2 x STANDARD
AT STANDARD
< STANDARD
Subindex (Health)
TECHNICAL EVALUATION NO. 2
CHANGE IN ENERGY CONSUMPTION
EFFECTIVE LIFE OF CORRECTIVE ACTION (Years)
Subindex
TECHNICAL EVALUATION #1
TECHNICAL EVALUATION #2
Index 17
COST OF CORRECTIVE ACTION
TECHNICAL EVALUATION
Corrective Action
Index 12
(See page 3)

FACILITY REQUIREMENTS

24 — EXPECTED LIFE OF HAZARDOUS OPERATION (Years)	23 — POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID HAZARD: LOW	MEDIUM	HIGH
>10	1	2	4
6–10	2	3	4
3–5	2	3	4
1–2	3	4	5
< 1	3	4	5

Facility Requirements Index 22

OVERALL EVALUATION

	FROM PAGE 1 (1a 1b)	FROM PAGE 2 (13)	(22)
	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES	1	4	1

APPENDIX D

EXAMPLES OF OCR GENERATED PROJECT REQUESTS

COMPUTER DATE 81FEB04

N A V O S H   P R O J E C T   C O N T R O L

PROPOSED PROJECT REPORT

(001) UIC: N65113
(002) SERIAL NO: H185A

****
* PROJ. NAME: VENTILATION SYSTEM CHANGES, BLDG 106 *
****

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20AUG79
DATE INPUT: C1
(004) DATE REVISED: 16JAN81
(206) PROJECT NMBR: C007-79

****

AGENCY: DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION

1. ACTIVITY: PUBLIC WORKS CENTER
ADDRESS : GREAT LAKES ILLINOIS

NAVFAC CONTACT: MR. DAVE SMITH; ENVIRONMENTAL ENG (A/V) 443-4972

N A R R A T I V E
(LIMIT OF 65 POSITIONS PER LINE INCLUDING SPACES AND PUNCTUATION)

2. PROBLEM DESCRIPTION:

(020)0010 THE EXISTING GARAGE EXHAUST SYSTEM HAS INADEQUATE CAPACITY AND
0020 NO MONITORING/ALARM CAPABILITY.

3. SPECIFIC HAZARD AND LOCATION:

(030)0010 RANDOM SAMPLING IN B106 GARAGE HAS INDICATED POTENTIAL CONCENTRA-
0020 TIONS OF CARBON MONOXIDE EXCEEDING 100 PPM; MORE THAN 50 PPM IN
0030 EXCESS OF THE STANDARD. THIS DEFICIENCY POSES A SERIOUS HEALTH
0040 HAZARD AFFECTING APPROXIMATELY 25 PEOPLE.

4. INTERIM CONTROL MEASURES:

(040)0010 SPORADIC SAMPLING OF B106 ENVIRONMENT; LIMITED UTILIZATION OF
0020 VEHICLE REPAIR STATIONS WITHIN BLDG; LEAVING EXTERIOR DOORS OPEN
0030 DURING HEAVY USE; AND CESSATION OF OPERATIONS WHEN ADVISED BY
0040 SAFETY MANAGER.

5. EFFECTIVENESS OF INTERIM CONTROL MEASURES:

(050)0010 INTERIM CONTROL MEASURES HAVE MINIMAL EFFECT DUE TO THEIR PASSIVE
0020 AND SPORADIC NATURE.

COPY 7 TO: SRI INTERNATIONAL

SERIAL NO: H185A

COMPUTER DATE 81FEB04

N A V O S H   P R O J E C T   C O N T R O L

PROPOSED PROJECT REPORT

(001) UIC: N65113
(002) SERIAL NO: H165A

****
* PROJ. NAME: VENTILATION SYSTEM CHANGES, BLDG 106 *
****

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20AUG79
DATE INPUT: 01
(004) DATE REVISED: 16JAN81
(206) PROJECT NMBR: C007-79

****

6. PROPOSED CORRECTIVE ACTION AND EFFECTIVENESS:

(060)0010 THE PROPOSED PROJECT WILL INCREASE THE CAPACITY OF THE EXHAUST
0020 SYSTEM AND EXTEND THE VENTIALATION CAPABILITIES THROUGHOUT THE
0030 WORK STATION AREAS. CONSEQUENTLY, CARBON MONOXIDE LEVELS WILL
0040 NOT BUILD UP. ADDITIONALLY, A CARBON MONOXIDE MONITORING AND
0050 AUTOMATIC ALARM SYSTEM WILL BE PROVIDED AS AN ACTIVE WARNING
0060 MEASURE.

7. OTHER RELEVANT INFORMATION:

(070)0010 LOCAL CONTACT: PWC ACTIVITY CIVIL ENGR (CODE 30A); ATVN:792-2397
0020 OR PWC SAFETY MANAGER (CODE 10A); ATVN:792-4919.

8. APPLICABLE STANDARDS:

(080)0010 29 CFR 1910.1000 STATES THAT AVERAGE CONCENTRATION OF CARBON
0020 MONOXIDE SHALL NOT EXCEED 50 PPM.

(DE)(LINE) (USE GUIDE BELOW FOR CHANGING DATA-IF NECESSARY USE REVERSE SIDE)

COPY 7 TO: SRI INTERNATIONAL

SERIAL NO: H185A

COMPUTER DATE 81FEB04

NAVOSH PROJECT CONTROL
PROPOSED PROJECT REPORT

(001) UIC: N65113
(002) SERIAL NO: H185A

* PROJ. NAME: VENTILATION SYSTEM CHANGES, BLDG 106 *

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20AUG79
DATE INPUT: 01
(004) DATE REVISED: 16JAN81
(206) PROJECT NMBR: C007-79

9. COST OF SAFETY AND HEALTH MEASURES: (IN THOUSANDS OF DOLLARS)
(200)

	FY (202)	CONSTRUCTION DESIGN (203)	FND	CONSTR (204)	FND (205)	REPAIR DESIGN	FND	CONSTR	FND	PROJECT NMBR (206)	CNTRCT NMBR
0010	80	5	YES	0	NO	0	NO	0	NO	C007-79	
0020	81	3	YES	48	NO	0	NO	0	NO	C007-79	
		TOTAL	56			TOTAL	0				

10. PROJECT SCHEDULE:

(100)

		AGENCY (MMM/YY)		REGULATION (MMM/YY)
DESIGN (START)	(912)	01APR80		
DESIGN (COMPLETION)	(901)	FEB81	(906)	_____
CONSTR (START)	(902)	APR81	(907)	_____
CONSTR (COMPLETION)	(903)	JUL81	(908)	_____
OPERATION (START)	(904)	JUL81	(909)	_____
FINAL COMPLIANCE	(905)	JUL81	(910)	NOV78

11. MISCELLANEOUS DATA:

(201) APPROPRIATION: O&MN

(013) MAJOR CLAIMANT: CNM

(013) SUB-CLAIMANT: NAVFAC

(008) REVISION NOTE: DOLLAR AND STATUS CHANGES

(015) HEALTH CATEGORY: 904 - RESPIRATORY CONDITIONS FROM TOXIC AGENTS

(016) HAZARD SUB-CATEGORY: 208 - INDUSTRIAL VENT.(EXCEPT WELDING,PLATING)

COPY 7 TO: SRI INTERNATIONAL

SERIAL NO: H185A

COMPUTER DATE 81FEB04

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N65113
(002) SERIAL NO: H185A

****
* PROJ. NAME: VENTILATION SYSTEM CHANGES, BLDG 106 *
****

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20AUG79
DATE INPUT: 01
(004) DATE REVISED: 16JAN81
(206) PROJECT NMBR: C007-79

****

(018) HAZARD CATEGORY: Z01 - CHEMICAL HAZARDS

(005) VARIOUS LOCATIONS: NO

(007) REMARKS:
(L I M I T O F 47 P O S I T I O N S)

(009) STATUS: UNDER DESIGN

12. BUILDINGS AFFECTED:

PROPERTY RECORD CARD NO:

NAVY CATEGORY CODE:

BUILDING NO:

13. HAZARD CONTROL ASSESSMENT: 121

1) SPECIFIC HAZARD:
CARBON MONOXIDE

2) HAZARD VIOLATION (REGULATIONS):
29CFR 1910.1000

3) CONCENTRATION OF HAZARD: 100.0000 PARTS/MILLION
ABOVE CIELING: NO

4) CURRENT STANDARD: 50.0000 PARTS/MILLION

5) TIME BETWEEN EXPOSURE AND HARMFULL IMPACTS: IMMEDIATE

6) NORMAL WORKING POPULATION EXPOSED TO HAZARD: 10-50

7) RATE OF EXPOSURE TO HAZARD (HOURS/YEAR PER PERSON): 960-2000

8) INSTALLED COST OF CORRECTIVE ACTION (K$): 41-60

9) CHANGE IN ANNUAL O&M COST (K$): (-5)-0

10) TIME TO ACCOMPLISH THE CONSTRUCTION (MONTHS): 10-12

11) ESTIMATED CONCENTRATION OF THE DESIGNATED HEALTH HAZARD UPON
COMPLETION: 5.0000 PARTS/MILLION

COPY 7 TO: SRI INTERNATIONAL SERIAL NO: H185A

N A V O S H   P R O J E C T   C O N T R O L

PROPOSED PROJECT REPORT

(001) UIC: N65113
(002) SERIAL NO: H185A

****
* PROJ. NAME: VENTILATION SYSTEM CHANGES, BLDG 106 *
****

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20AUG79
DATE INPUT: 01
(004) DATE REVISED: 16JAN81
(206) PROJECT NMBR: C007-79

****

13. HAZARD CONTROL ASSESSMENT (CONT.)

12) CHANGE IN ENERGY CONSUMPTION CAUSED BY CORRECTIVE ACTION (MEGA-BTU/YEAR): 1-500

13) EFFECTIVE LIFE OF CORRECTIVE ACTION (YEARS): >=10

14) POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID THE HAZARD: LOW

15) EXPECTED LIFE OF HAZARDOUS OPERATION (YEARS): >10

NOTE — AN ASTERISK (*) INDICATES THAT THIS DIGIT OF THE HAZARD CONTROL ASSESSMENT CAN NOT BE CALCULATED BECAUSE INFORMATION IS INCOMPLETE.

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N00228
(002) SERIAL NO: H228A

* PROJ. NAME: INSTALL ACOUSTICAL BAFFLES *

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 09AUG79
DATE INPUT: 01
(004) DATE REVISED: 10FEB81
(205) PROJECT NMBR: C004-79

AGENCY: DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
WESTERN DIVISION

1. ACTIVITY: SUPPLY CENTER
ADDRESS : OAKLAND CALIF

NAVFAC CONTACT: MR. CARL MANDLER; HEAD ENVIRONMENTAL BR (A/V) 859-7499

N A R R A T I V E
(LIMIT OF 65 POSITIONS PER LINE INCLUDING SPACES AND PUNCTUATION)

2. PROBLEM DESCRIPTION:

(020)0010 WOOD WORKING MACHINE NOISE EXCEEDS OSHA ST'D OF 90.DBA.

3. SPECIFIC HAZARD AND LOCATION:

(030)0010 THE WOOD WORKING MACHINES IN BLDGS. 433, 513 AND 532 CREATE
0020 EXCESSIVELY HIGH LEVELS OF NOISE (ABOVE 90 BA). THIS LEVEL OF
0030 NOISE IS IN VIOLATION OF NAVY ST'D AND IS INJURIOUS TO HEARING
0040 OF PERSONNEL OPERATING THE EQUIPMENT.

4. INTERIM CONTROL MEASURES:

(040)0010 HAZARDOUS NOISE AREAS HAVE BEEN PLACARDED. HEARING PROTECTION
0020 HAS BEEN ISSUED TO PERSONNEL EXPOSED TO HIGH NOISE LEVELS.
0030 HEARING TESTS FOR PERSONS ARE CONDUCTED ANNUALLY.

5. EFFECTIVENESS OF INTERIM CONTROL MEASURES:

(050)0010 ASSUMING THAT PERSONNEL WEAR THE PROTECTIVE
0020 DEVICES ISSUED. THE WORK PLACE IS SAFE
0030 HOWEVER. PERSONNEL PROTECTIVE DEVICES IS
0040 TEMPORARY SOLUTION ONLY.

COPY 7 TO: SRI INTERNATIONAL

SERIAL NO: H228A

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N00228
(002) SERIAL NO: H228A

****
* PROJ. NAME: INSTALL ACOUSTICAL BAFFLES *
****

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 09AUG79
DATE INPUT: 01
(004) DATE REVISED: 10FEB81
(206) PROJECT NMBR: C034-79

****

6. PROPOSED CORRECTIVE ACTION AND EFFECTIVENESS:

(060)0010 IT IS PROPOSED TO ALLEVIATE THE NOISE PROBLEM

0020 WITH A COMBINATION OF OBSORPTIVE ACCOUSTICAL

0030 PANALS, ACCOUSTIC ENCLOSURES AND NEW

0040 EQUIPMENT.

7. OTHER RELEVANT INFORMATION:

(070)0010 LOCAL CONTACT: L. AKSIONCYZK, LCDR CEC, STAFF CIVIL ENGINEER,

0020 AUTOVON 836-6491

8. APPLICABLE STANDARDS:

(080)0010 OPNAVINST 6260.2

0020 29 CFR 1910.95 STATES THAT PROTECTION AGAINST NOISE EXPOSURE

0030 EXCEEDING 90 DBA FOR AN EIGHT HOUR DAY SHALL BE PROVIDED.

(DE)(LINE) (USE GUIDE BELOW FOR CHANGING DATA-IF NECESSARY USE REVERSE SIDE)

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COPY 7 TO: SRI INTERNATIONAL   SERIAL NO: H228A

COMPUTER DATE 81FEB12

NAVOSH PROJECT CONTROL

PROPOSED PROJECT REPORT

(001) UIC: N00228
(002) SERIAL NO: H228A

* PROJ. NAME: INSTALL ACOUSTICAL BAFFLES *

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 09AUG79
DATE INPUT: 01
(004) DATE REVISED: 10FEB81
(206) PROJECT NMBR: C004-79

9. COST OF SAFETY AND HEALTH MEASURES: (IN THOUSANDS OF DOLLARS)
(200)

	FY (202)	CONSTRUCTION DESIGN (203)	FND	CONSTR (204)	FND (205)	REPAIR DESIGN	FND	CONSTR	FND	PROJECT NMBR (206)	CNTRCT NMBR
0010	81	5	NO	82	NO	0	NO	0	NO	C004-79	
		TOTAL	87			TOTAL	0				

10. PROJECT SCHEDULE:

(100)		AGENCY (MMM/YY)		REGULATION (MMM/YY)
DESIGN (START)	(912)	01MAR81		
DESIGN (COMPLETION)	(901)	JUN81	(906)	-----
CONSTR (START)	(902)	SEP81	(907)	-----
CONSTR (COMPLETION)	(903)	MAY82	(908)	-----
OPERATION (START)	(904)	SEP81	(909)	-----
FINAL COMPLIANCE	(905)	SEP81	(910)	SEP79

11. MISCELLANEOUS DATA:

(201) APPROPRIATION: OGMN

(013) MAJOR CLAIMANT: CNM

(013) SUB-CLAIMANT: NAVSUP

(008) REVISION NOTE: FISCAL AND DOLLAR CHANGES

(015) HEALTH CATEGORY: 907 - DISEASES DUE TO REPEATED TRAUMA

(016) HAZARD SUB-CATEGORY: 221 - OCCUPATIONAL NOISE

(018) HAZARD CATEGORY: 202 - PHYSICAL HAZARDS

(005) VARIOUS LOCATIONS: NO

OPY 7 TO: SRI INTERNATIONAL SERIAL NO: H228A

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N00228
(002) SERIAL NO: H228A

****

* PROJ. NAME: INSTALL ACOUSTICAL BAFFLES *

****

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 09AUG79
DATE INPUT: 01
(004) DATE REVISED: 10FEB81
(206) PROJECT NMBR: C004-79

****

(007) REMARKS:
(L I M I T O F 47 P O S I T I O N S)

(009) STATUS: PRELIMINARY PLANNING

12. BUILDINGS AFFECTED:

PROPERTY RECORD CARD NO:

NAVY CATEGORY CODE:

BUILDING NO:

13. HAZARD CONTROL ASSESSMENT: 231

1) SPECIFIC HAZARD:
NOISE LEVELS EXCEED 90 DBA

2) HAZARD VIOLATION (REGULATIONS):
29CFR OPNAVINST 6260.2

3) CONCENTRATION OF HAZARD: 97.0000 DECIBALS
ABOVE CIELING: NO

4) CURRENT STANDARD: 85000.0000 DECIBALS

5) TIME BETWEEN EXPOSURE AND HARMFULL IMPACTS: IN YEARS

6) NORMAL WORKING POPULATION EXPOSED TO HAZARD: 10-50

7) RATE OF EXPOSURE TO HAZARD (HOURS/YEAR PER PERSON): >2000

8) INSTALLED COST OF CORRECTIVE ACTION (K$): 81-100

9) CHANGE IN ANNUAL O&M COST (K$): (-5)-0

10) TIME TO ACCOMPLISH THE CONSTRUCTION (MONTHS): 10-12

11) ESTIMATED CONCENTRATION OF THE DESIGNATED HEALTH HAZARD UPON
COMPLETION: 85.0000 DECIBALS

12) CHANGE IN ENERGY CONSUMPTION CAUSED BY CORRECTIVE ACTION
(MEGA-BTU/YEAR): (-500)-0

COPY 7 TO: SRI INTERNATIONAL   SERIAL NO: H228A

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L

PROPOSED PROJECT REPORT

(001) UIC: N00228
(002) SERIAL NO: H228A

* PROJ. NAME: INSTALL ACOUSTICAL BAFFLES *

PROGRAM: HEALTH
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 09AUG79
DATE INPUT: 01
(004) DATE REVISED: 10FEB81
(206) PROJECT NMBR: C004-79

13. HAZARD CONTROL ASSESSMENT (CONT.)

13) EFFECTIVE LIFE OF CORRECTIVE ACTION (YEARS): >=10

14) POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID THE HAZARD: LOW

15) EXPECTED LIFE OF HAZARDOUS OPERATION (YEARS): >10

NOTE -- AN ASTERISK (*) INDICATES THAT THIS DIGIT OF THE HAZARD CONTROL ASSESSMENT CAN NOT BE CALCULATED BECAUSE INFORMATION IS INCOMPLETE.

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SERIAL NO: H228A

COMPUTER DATE 81FEB12

NAVOSH PROJECT CONTROL
PROPOSED PROJECT REPORT

(001) UIC: N00334
(002) SERIAL NO: Y315A

****
* PROJ. NAME: REPAIR BRIDGE CRANES,HGR 117 *
****

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 25AUG78
DATE INPUT:
(004) DATE REVISED: 11FEB81
(205) PROJECT NMBR: R021-78

****

AGENCY: DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
PACIFIC DIVISION

1. ACTIVITY: AIR STATION
ADDRESS : BARBERS POINT HAWAII

NAVFAC CONTACT: MR. CLYDE YOKOTA: ENVIRONMENTAL ENG (A/V) 471-3948

N A R R A T I V E
(LIMIT OF 65 POSITIONS PER LINE INCLUDING SPACES AND PUNCTUATION)

2. PROBLEM DESCRIPTION:

(02)0010 RAILS AND BRIDGES SUPPORTING TWO EXISTING 5-TON ELECTRIC HOISTS

0020 ARE DETERIORATED AND CANNOT SAFELY SUPPORT LOAD.

3. SPECIFIC HAZARD AND LOCATION:

(03)0010 A RECENT STRUCTURAL ANALYSIS OF THE BRIDGE CRANE SYSTEM REVEALED

0020 THAT RATED LOAD OF HOISTS CANNOT BE SAFELY LIFTED AND TRANSPORTED

0030 BY THE SYSTEM. LIFTING ANYTHING GREATER POSES SERIOUS SAFETY

0040 HAZARD TO APPROXIMATELY 200 PEOPLE WORKING IN AIMD HANGAR 117.

4. INTERIM CONTROL MEASURES:

(04)0010 LIFTING CAPACITY HAS BEEN REDUCED AND OPERATING PERSONNEL ARE

0020 REMINDED OF THIS REDUCED LOADING. LARGE WARNING SIGNS ARE

0030 PROPERLY POSTED.

5. EFFECTIVENESS OF INTERIM CONTROL MEASURES:

(05)0010 INTERIM CONTROL ONLY EFFECTIVE WHEN PROPERLY EXERCISED AND

0020 CONTROLLED. THIS IS ONLY A TEMPORARY SOLUTION.

6. PROPOSED CORRECTIVE ACTION AND EFFECTIVENESS:

(06)0010 REPLACING OUTDATED BRIDGE CRANE HOISTS AND SUPPORTING STRUCTURAL

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COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT
(001) UIC: N00334
(002) SERIAL NO: Y315A

* PROJ. NAME: REPAIR BRIDGE CRANES,HGR 117 *

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC
(003) DATE PREPARED: 25AUG78
DATE INPUT:
(004) DATE REVISED: 11FEB81
(206) PROJECT NMBR: R021-78

6. PROPOSED CORRECTIVE ACTION AND EFFECTIVENESS:

(060)0020 MEMBERS IS THE ONLY ACCEPTED REMEDIAL SOLUTION FOR GOOD SAFETY

0030 PRACTICE

7. OTHER RELEVANT INFORMATION:

(070)0010 LOCAL CONTACT: MR. ALFRED ABE; AV 430-0111 EXT 684-8201

8. APPLICABLE STANDARDS:

(080)0010 29 CFR 1910.179L (1),(2),(3): L(3) OVERHEAD AND GANTRY CRANES,

0020 REQUIRE REPLACEMENT OF OUTDATED UNSAFE OPERATING BRIDGE CRANES.

(DE)(LINE) (USE GUIDE BELOW FOR CHANGING DATA-IF NECESSARY USE REVERSE SIDE)

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SERIAL NO: Y315A

AD-A123 886 NAVOSH PRIORITY METHODOLOGY(U) SRI INTERNATIONAL MENLO PARK CA A G CAPPS MAR 82 N00014-79-C-0432 3/3

UNCLASSIFIED F/G 13/12 NL

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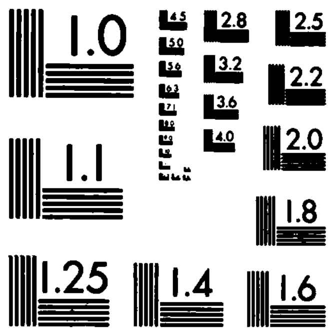

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N00334
(002) SERIAL NO: Y315A

* PROJ. NAME: REPAIR BRIDGE CRANES,HGR 117 *

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 25AUG78
DATE INPUT:
(004) DATE REVISED: 11FEB81
(206) PROJECT NMBR: R021-78

9. COST OF SAFETY AND HEALTH MEASURES: (IN THOUSANDS OF DOLLARS)
(200)

	CONSTRUCTION				REPAIR				PROJECT	CNTRCT
FY (202)	DESIGN (203)	FND	CONSTR (204)	FND (205)	DESIGN	FND	CONSTR	FND	NMBR (206)	NMBR
0010 UP	8	NO	88	NO	0	NO	0	NO	R021-78	
	TOTAL		96		TOTAL		0			

10. PROJECT SCHEDULE:

(100)

		AGENCY (MMM/YY)		REGULATION (MMM/YY)
DESIGN (START)	(912)	_____		
DESIGN (COMPLETION)	(901)	_____	(906)	_____
CONSTR (START)	(902)	_____	(907)	_____
CONSTR (COMPLETION)	(903)	_____	(908)	_____
OPERATION (START)	(904)	_____	(909)	_____
FINAL COMPLIANCE	(905)	_____	(910)	_____

11. MISCELLANEOUS DATA:

(201) APPROPRIATION: O&MN

(013) MAJOR CLAIMANT: PACFLT

(013) SUB-CLAIMANT: **********

(008) REVISION NOTE:

(015) HEALTH CATEGORY: 901 - OCCUPATIONAL INJURIES

(016) HAZARD SUB-CATEGORY: 228 - CRANES,DERRICKS, HOISTS,ELEVATORS,CONV'R

(016) HAZARD CATEGORY: 202 - PHYSICAL HAZARDS

(005) VARIOUS LOCATIONS: NO

COPY 7 TO: SRI INTERNATIONAL

SERIAL NO: Y315A

COMPUTER DATE 81FEB12

NAVOSH PROJECT CONTROL

PROPOSED PROJECT REPORT

(001) UIC: N00334

(002) SERIAL NO: Y315A

****

* PROJ. NAME: REPAIR BRIDGE CRANES,HGR 117 *

****

PROGRAM: SAFETY

FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 25AUG78

DATE INPUT:

(004) DATE REVISED: 11FEB81

(206) PROJECT NMBR: R021-78

****

(007) REMARKS:

(LIMIT OF 47 POSITIONS)

(009) STATUS: PRELIMINARY PLANNING

12. BUILDINGS AFFECTED:

PROPERTY RECORD CARD NO:

NAVY CATEGORY CODE:

BUILDING NO:

13. HAZARD CONTROL ASSESSMENT: 131

1) SPECIFIC HAZARD:
UNSAFE OVERHEAD HOIST

2) HAZARD VIOLATION (REGULATIONS):
OSHA 1910.179 (1),(2),(3)

3) PROBABILITY: PROBABLE

4) SEVERITY OF MOST LIKELY INJURY:
DEATH

5) DAYS LOST PER INCIDENT: 4200

6) NORMAL WORKING POPULATION EXPOSED TO HAZARD: >50

7) RATE OF EXPOSURE TO HAZARD (HOURS/YEAR PER PERSON): 151-959

8) INSTALLED COST OF CORRECTIVE ACTION (K$): >100

9) CHANGE IN ANNUAL O&M COST (K$): 1-5

10) TIME TO ACCOMPLISH THE CONSTRUCTION (MONTHS): 13-24

11) SAFETY PROJECT IN FULL LEGAL COMPLIANCE UPON COMPLETION: YES

12) CHANGE IN ENERGY CONSUMPTION CAUSED BY CORRECTIVE ACTION
(MEGA-BTU/YEAR): 1-500

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SERIAL NO: Y315A

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N00334
(002) SERIAL NO: Y315A

****
* PROJ. NAME: REPAIR BRIDGE CRANES,HGR 117 *
****

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 25AUG78
DATE INPUT:
(004) DATE REVISED: 11FEB81
(205) PROJECT NMBR: R021-78

****

13. HAZARD CONTROL ASSESSMENT (CONT.)

13) EFFECTIVE LIFE OF CORRECTIVE ACTION (YEARS): >=10

14) POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID THE HAZARD: LOW

15) EXPECTED LIFE OF HAZARDOUS OPERATION (YEARS): >10

NOTE -- AN ASTERISK (*) INDICATES THAT THIS DIGIT OF THE HAZARD CONTROL ASSESSMENT CAN NOT BE CALCULATED BECAUSE INFORMATION IS INCOMPLETE.

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SERIAL NO: Y315A

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N62431
(002) SERIAL NO: Y322A

****
* PROJ. NAME: REPLACE POWER OPERATED GUILLOTINE PAPER CUTTER *
****

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20JUN80
DATE INPUT: 01
(004) DATE REVISED: 11FEB81
(206) PROJECT NMBR: E031-83

****

AGENCY: DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
CHESAPEAKE DIVISION

1. ACTIVITY: DEFENSE PRINTING SERVICE
ADDRESS : WASHINGTON DC

NAVFAC CONTACT: MS. C. EASTER: PROGRAM ANALYST (A/V) 286-3761

N A R R A T I V E
(LIMIT OF 65 POSITIONS PER LINE INCLUDING SPACES AND PUNCTUATION)

2. PROBLEM DESCRIPTION:

(020)0010 NO EFFECTIVE POINT OF OPERATION GUARD ON 24 YEAR OLD GUILLOTINE
0020 PAPER CUTTER.

3. SPECIFIC HAZARD AND LOCATION:

(030)0010 OPERATORS OF 64 INCH (MODEL) 102F GUILLOTINE CUTTER ARE EXPOSED
0020 TO LOWER ARM AMPUTATION BECAUSE OPERATORS REACH AFTER BLADE IS
0030 ACTUATED TO JOG STACKS OF PAPER STOCK. NOT TECHNICALLY FEASIBLE
0040 TO ALTER 24 YEAR OLD CUTTER AT ANY COST. LOCATED IN DPS,
0050 BINDERY DIVISION, RM BC 862.

4. INTERIM CONTROL MEASURES:

(040)0010 SIGNS WARNING AUTHORIZED OPERATORS OF SAFETY HAZARDS ARE POSTED
0020 ON EQUIPMENT. UNABLE TO FABRICATE TOOL THAT CAN ALIGN PAPER
0030 WITHOUT DAMAGING STOCK.

5. EFFECTIVENESS OF INTERIM CONTROL MEASURES:

(050)0010 CANNOT RELY ON OPERATOR COOPERATION AND CONSTANT VIGILIANCE
0020 TO USE CONTROLS AS INSTRUCTED. OPERATORS MAY BECOME
0030 PREOCCUPIED OR INVOLVED WITH TASK OF THE MOMENT AND TAKE

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT
(001) UIC: N62401
(002) SERIAL NO: Y322A

****
* PROJ. NAME: REPLACE POWER OPERATED GUILLOTINE PAPER CUTTER *
****
PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC
(003) DATE PREPARED: 20JUN80
DATE INPUT: 01
(004) DATE REVISED: 11FEB81
(205) PROJECT NMBR: E001-80
****

5. EFFECTIVENESS OF INTERIM CONTROL MEASURES:

(050)0040 UNECESSARY RISKS.

6. PROPOSED CORRECTIVE ACTION AND EFFECTIVENESS:

(060)0010 REPLACE WITH CUTTER HAVING DUAL HAND CONTROLS WHICH WHEN RELEASED

0020 STOP THE DOWNWARD STROKE OF BLADE BEFORE OPERATOR CAN REACH INTO

0030 POINT OF OPERATION AND A LIGHT BEAM BARRIER ACROSS POINT OF

0040 OPERATION WHICH IMMEDIATELY STOPS KNIFE IF LIGHT BEAM

0050 INTERRUPTED.

7. OTHER RELEVANT INFORMATION:

(070)0010 JAMES R. TURNER

0020 PRINTING MGMT. INTERN

0030 (202) 697-2791

8. APPLICABLE STANDARDS:

(080)0010 29 CFR 1910.212 (A)(1)

0020 29 CFR 1910.212 (A)(3)(IV)

0030 29 CFR 1910.217 (B)(6)

(DE)(LINE) (USE GUIDE BELOW FOR CHANGING DATA-IF NECESSARY USE REVERSE SIDE)

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COMPUTER DATE 81FE812

NAVOSH PROJECT CONTROL
PROPOSED PROJECT REPORT

(001) UIC: N62401
(002) SERIAL NO: Y322A

* PROJ. NAME: REPLACE POWER OPERATED GUILLOTINE PAPER CUTTER *

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20JUN80
DATE INPUT: 01
(004) DATE REVISED: 11FE881
(206) PROJECT NMBR: E001-80

9. COST OF SAFETY AND HEALTH MEASURES: (IN THOUSANDS OF DOLLARS)
(200)

	FY (202)	CONSTRUCTION DESIGN (203)	FND	CONSTRUCTION CONSTR (204)	FND (205)	REPAIR DESIGN	FND	REPAIR CONSTR	FND	PROJECT NMBR (206)	CNTRCT NMBR
0010	81	0	YES	55	YES	0	NO	0	NO	E001-80	
		TOTAL	55			TOTAL	0				

10. PROJECT SCHEDULE:

(100)

		AGENCY (MMM/YY)		REGULATION (MMM/YY)
DESIGN (START)	(912)	-----		
DESIGN (COMPLETION)	(901)	-----	(906)	-----
CONSTR (START)	(902)	JAN81	(907)	-----
CONSTR (COMPLETION)	(903)	JUN81	(908)	-----
OPERATION (START)	(904)	JUL81	(909)	-----
FINAL COMPLIANCE	(905)	JUL81	(910)	APR71

11. MISCELLANEOUS DATA:

(201) APPROPRIATION: OPN

(013) MAJOR CLAIMANT: CNM

(013) SUB-CLAIMANT: NAVSUP

(008) REVISION NOTE: FISCAL, DOLLAR AND STATUS CHANGES

(015) HEALTH CATEGORY: 901 - OCCUPATIONAL INJURIES

(016) HAZARD SUB-CATEGORY: 225 - MACHINE GUARDING,ANCHORING,GUARD RAILS

(018) HAZARD CATEGORY: 202 - PHYSICAL HAZARDS

(005) VARIOUS LOCATIONS: NO

COPY 7 TO: SRI INTERNATIONAL

SERIAL NO: Y322A

COMPUTER DATE 81FEB12

NAVOSH PROJECT CONTROL
PROPOSED PROJECT REPORT

(001) UIC: N62401
(002) SERIAL NO: Y322A

* PROJ. NAME: REPLACE POWER OPERATED GUILLOTINE PAPER CUTTER *

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20JUN80
DATE INPUT: 01
(004) DATE REVISED: 11FEB81
(205) PROJECT NMBR: E001-80

(007) REMARKS:
(LIMIT OF 47 POSITIONS)

(009) STATUS: UNDER CONSTRUCTION

12. BUILDINGS AFFECTED:

PROPERTY RECORD CARD NO:

NAVY CATEGORY CODE:

BUILDING NO:

13. HAZARD CONTROL ASSESSMENT: 111

1) SPECIFIC HAZARD:
GUILLOTINE CUTTER-OPERATION GUARD

2) HAZARD VIOLATION (REGULATIONS):
29CFR 1910.212 (A) (1) 1910.212 (A) (3) (IV) 1910.217(B)(6)

3) PROBABILITY: LIKELY

4) SEVERITY OF MOST LIKELY INJURY:
BILATERAL AMPUTATION OF ARMS BELOW ELBOW

5) DAYS LOST PER INCIDENT: 2500-4199

6) NORMAL WORKING POPULATION EXPOSED TO HAZARD: 1-4

7) RATE OF EXPOSURE TO HAZARD (HOURS/YEAR PER PERSON): >2000

8) INSTALLED COST OF CORRECTIVE ACTION (K$): 41-60

9) CHANGE IN ANNUAL O&M COST (K$): (-5)-0

10) TIME TO ACCOMPLISH THE CONSTRUCTION (MONTHS): 1-3

11) SAFETY PROJECT IN FULL LEGAL COMPLIANCE UPON COMPLETION: YES

12) CHANGE IN ENERGY CONSUMPTION CAUSED BY CORRECTIVE ACTION
(MEGA-BTU/YEAR): (-500)-0

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SERIAL NO: Y322A

COMPUTER DATE 81FEB12

N A V O S H   P R O J E C T   C O N T R O L
PROPOSED PROJECT REPORT

(001) UIC: N62401
(002) SERIAL NO: Y322A

****
* PROJ. NAME: REPLACE POWER OPERATED GUILLOTINE PAPER CUTTER *
****

PROGRAM: SAFETY
FUNDING COMMAND: NAVFAC

(003) DATE PREPARED: 20JUN80
DATE INPUT: 01
(004) DATE REVISED: 11FEB81
(205) PROJECT NMBR: E001-80

****

13. HAZARD CONTROL ASSESSMENT (CONT.)

13) EFFECTIVE LIFE OF CORRECTIVE ACTION (YEARS): >=10

14) POTENTIAL FOR RELOCATING THE PROCESS OR FUNCTION TO AVOID THE HAZARD: LOW

15) EXPECTED LIFE OF HAZARDOUS OPERATION (YEARS): >10

NOTE -- AN ASTERISK (*) INDICATES THAT THIS DIGIT OF THE HAZARD CONTROL ASSESSMENT CAN NOT BE CALCULATED BECAUSE INFORMATION IS INCOMPLETE.

COPY 7 TO: SRI INTERNATIONAL

SERIAL NO: Y322A

Appendix E

ADDENDUM

In April 1981 the Naval Facilities Engineering Command forwarded a revision to the format and content of the matrices on pages B-22 to B-24. They represent later information on the system to be installed. The following pages show those revisions.

EXHIBIT C (Sheet 1 of 3)
HAZARD CONTROL ASSESSMENT FOR RISK (Revised)

SAFETY MISHAP PROFILE

5 IMPACT OF OCCURRENCE (Days lost per incident) / 3 PROBABILITY OF OCCURRENCE OF INJURY	LIKELY	PROBABLE	POSSIBLE	UNLIKELY
4200	1	1	2	3
2500–4199	1	2	2	3
1200–2499	2	2	3	4
400–1199	2	2	3	4
199–399	2	3	3	4
30–99	3	3	4	5
< 30	3	3	4	5

PERSONNEL EXPOSURE

7 EXPOSURE (Hours/yr per person exposed) / 6 POPULATION (PERSONS)	> 50	10–50	5–9	1–4
≥ 2000	1	1	2	2
960–1999	1	1	2	3
151–959	2	2	3	4
40–150	2	3	4	5
< 40	3	4	5	5

HEALTH HAZARD SEVERITY

3 4 CONCENTRATION / 5 TIME BETWEEN EXPOSURES AND HARMFUL IMPACTS	IMMEDIATE	IN MONTHS	IN YEARS
ABOVE CEILING	1	1	2
> 2 x STANDARD	1	2	3
< 2 x STANDARD	1	3	4

PERSONNEL EXPOSURE / SAFETY MISHAP PROFILE	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Safety Risk

PERSONNEL EXPOSURE / HEALTH HAZARD SEVERITY	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Health Risk

* NUMBERS CORRESPOND TO BASIC DATA ITEMS SHOWN ON EXHIBIT A

HA-1440-4

EXHIBIT C (Sheet 2 of 3)
HAZARD CONTROL ASSESSMENT — CORRECTIVE ACTION (Revised)

COST OF CORRECTIVE ACTION

9 CHANGE IN ANNUAL O&M COSTS ($ × 10³) \ 8 INSTALLED COST OF CORRECTIVE ACTION (incl. environmental control technology) ($ × 10³)	≤ 40	41-60	61-80	81-100	>100
< (-5)	1	1	2	3	4
(-5)-0	1	2	2	3	4
0-5	2	2	3	4	5
5-10	2	3	3	4	5
> 10	2	3	4	5	5

TECHNICAL EVALUATION No. 1a (Safety)

5 LIKELY IMPACT (DAYS LOST) \ 10 TIME TO ACCOMPLISH CORRECTIVE ACTION (MONTHS)	1-3	4-6	7-9	10-12	13-24	>24
4200	1	1	1	1	1	1
2500-4199	1	1	1	1	2	2
1200-2449	1	1	1	2	2	2
400-1199	1	2	2	3	3	3
100-399	1	2	2	3	4	4
30-99	2	3	3	4	4	4
< 30	3	4	4	5	5	5

TECHNICAL EVALUATION No. 1b (Health)

3 4 CONCENTRATION BEFORE CORRECTION \ 10 TIME TO ACCOMPLISH CORRECTIVE ACTION (MONTHS)	1-3	4-6	7-9	10-12	13-24	>24
ABOVE CEILING	1	1	1	1	2	2
> 2 x STANDARD	1	1	2	2	3	3
< 2 x STANDARD	2	2	3	4	5	5

TECHNICAL EVALUATION NO. 2

13 LIFE OF CORRECTIVE ACTION (Years) \ 12 CHANGE IN ENERGY CONSUMPTION (10^6 Btu)	< (-500)	(-500)-0	1-500	501-1000	> 1000
> 10	1	1	2	2	3
5-9	1	2	2	3	4
3-4	2	2	3	4	4
1-2	2	3	4	4	5
< 1	3	4	4	5	5

TECHNICAL EVALUATION #1

TECHNICAL EVALUATION #2 \ TECHNICAL EVALUATION #1	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

COST OF CORRECTIVE ACTION

TECHNICAL EVALUATION \ COST OF CORRECTIVE ACTION	1	2	3	4	5
1	1	1	2	2	3
2	1	2	3	3	4
3	2	3	3	4	4
4	2	3	4	4	5
5	3	4	4	5	5

Corrective Action

HA-1440-5

EXHIBIT C (Sheet 3 of 3)
HAZARD CONTROL ASSESSMENT (Revised)

FACILITY REQUIREMENTS

14 / 15		POTENTIAL FOR RELOCATION		
EXPECTED LIFE OF HAZARDOUS OPERATION (Years)		LOW	MEDIUM	HIGH
	>10	1	2	4
	6–10	2	3	4
	3–5	2	3	4
	1–2	3	4	5
	< 1	3	4	5

Facility Requirements

OVERALL EVALUATION

FROM PAGE 1

FROM PAGE 2

	RISK	CORRECTIVE ACTION	FACILITY REQUIREMENT
SCORES			

HA-1440-6

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